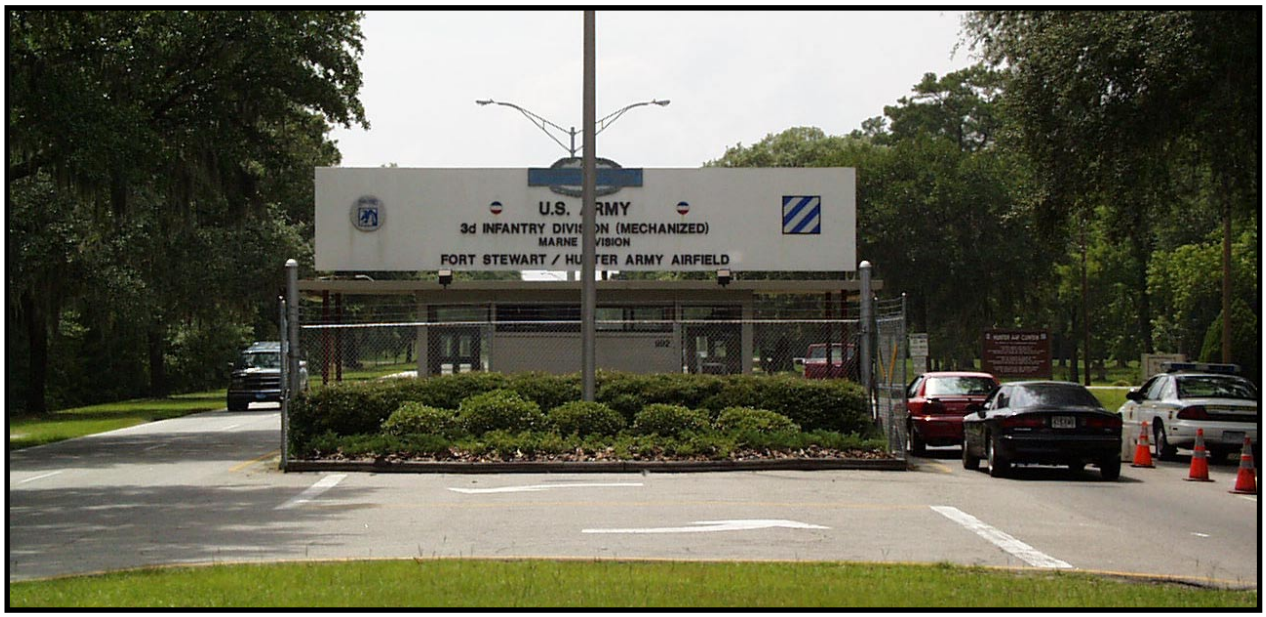
Hunter Army Airfield, Georgia
Gate Access
Traffic Engineering Study



prepared for

Military Traffic Management Command
Transportation Engineering Agency
and
Norfolk District Corps of Engineers

September 2000

prepared by

Gannett Fleming

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EXECUTIVE SUMMARY

Scope

The Military Traffic Management Command Transportation Engineering Agency (MTMCTEA), through Gannett Fleming, conducted a Gate Access Traffic Engineering Study at Hunter Army Airfield (HAAF), Georgia from 4-9 June 2000. The main objective of the study was to investigate traffic operations at the existing gates and their neighboring intersections and to make recommendations as to the feasibility and location of an additional gate or gates for Hunter Army Airfield. The final recommendation addressed strategic mobility and the daily traffic demands of HAAF and the City of Savannah.

Findings and Recommendations

This report analyzed three gates at HAAF along with the major intersections immediately outside of these gates:

- Montgomery Gate & the Intersection of Derenne Avenue with Montgomery Street
- Wilson Gate & the Intersection of White Bluff Road with Stephenson Avenue
- Rio Road Gate & the Intersection of Abercorn Street with Rio Road

Gannett Fleming engineers performed traffic analyses to assist officials in determining gate staffing priorities and to identify potential locations for constructing a future gate. In addition, we identified traffic and safety problems at each gate and provided conceptual improvements to address the problems.

Findings	***Recommendations***
SHORT-TERM	
Montgomery Gate	
• Mildred St used as cut-thru. • Numerous conflict points at gate area. • View of STOP sign blocked along Mildred Street.	• Install directional, slip median. • Install “HAAF and Local Traffic” signs along Mildred Street.
Intersection of Derenne Avenue with Montgomery Street	
• 197 crashes in 3 years. • Tight turning radii on southwest corner. • Narrow lanes in the eastbound and westbound directions. • Red light violations resulting. • Level of service of C and D in the morning and evening, respectively. • Congestion blocking the intersection. • Drivers ignoring “NO TURN ON RED” signs.	• Increase radii on southwest corner. • Increase 8’-3” lanes to governing minimums. • Increase Yellow + All Red time. • Introduce red light running cameras if legislation permits. • Test NYC’s “Do Not Block the Box” program to discourage the blocking of intersections. • Install a span mounted “NO TURN ON RED” sign on the northbound approach.
Intersection of White Bluff Road with Stephenson Avenue	
• 142 crashes in 3 years. • Level of service of C and F in the morning and	• Increase Yellow + All Red time. • Split phase Stephenson Avenue.

evening, respectively. • Confusing geometry and phasing results in vehicle conflicts.	• Install "NO U-TURN" signs on the northbound and southbound approaches. • Install lane use control signs on the eastbound and westbound approaches.
Intersection of Abercorn Street with Rio Road	
• 224 crashes in 3 years. • Level of service of B and E in the morning and evening, respectively.	• Increase Yellow + All Red time.
LONG-TERM	
Access Locations	
• Area traffic growth of 2.5% per year. • Existing access points in congested areas. • 2000 to 3000 soldiers deployed from Ft Stewart to HAAF, weekly. • HAAF expansion including Sabre Hall Ranger Complex.	• Definite need for additional accessing benefiting HAAF and the City of Savannah. • Three alternatives investigated: **Alternative 1** - $21.6 million, B/C of 0.19 **Alternative 2** - $29.6 million, B/C of 0.14 **Alternative 3** - $1.4 million, B/C of 3.01
Gate Automation	
• Manpower constraints make staffing of existing gates difficult. • Security and safety of guards is an installation concern.	• Implementation of gate automation is recommended. • Cost of implementation is $180,000. • CCTV would provide remote surveillance for security and operations.

Further Assistance

Findings and recommendations in this report are based on review of crash reports and on analyses of data obtained during field surveys conducted between 4-9 June 2000. Questions regarding the recommendations in this report should be referred to MTMCTEA for resolution.

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FINDINGS AND RECOMMENDATIONS

Methodology

This report analyzed three gates at HAAF along with the intersections immediately outside of these gates:

- Montgomery Gate & the Intersection of Derenne Avenue with Montgomery Street
- Wilson Gate & the Intersection of White Bluff Road with Stephenson Avenue
- Rio Road Gate & the Intersection of Abercorn Street with Rio Road

Gannett Fleming engineers performed traffic analyses to assist officials in determining gate staffing priorities and to identify potential locations for constructing a future gate. In addition, we identified traffic and safety problems at each gate and provided conceptual improvements to address the problems.

The study team performed the following tasks to identify and resolve traffic and safety concerns at the study locations:

1. ***Data Collection*** – Morning, mid-day, and evening peak-hour turning movement counts were conducted by Gannett Fleming or obtained from the City of Savannah at the three study intersections. Twenty-four hour traffic volume data was collected at all existing gates. Crash location data was obtained from the City of Savannah.

2. ***Field Investigations*** – Several field observations were conducted to assess traffic flow and safety operations at study gates and intersections. Traffic operations were monitored during critical time periods to help identify safety deficiencies.

3. ***Analysis and Problem Identification*** – Data was analyzed using traffic engineering and safety standards from the following sources:

    - *Highway Capacity Manual* (HCM), Transportation Research Board Special Report 209, 1994 and 1997
    - Highway Capacity Software (HCS), developed by FHWA and distributed by McTrans
    - *Manual on Uniform Traffic Control Devices (MUTCD),* FHWA, 1988
    - *A Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials (AASHTO), 1994
    - *Roadside Design Guide*, American Association of State Highway and Transportation Officials (AASHTO), 1996
    - *Traffic Engineering Handbook*, 4th Edition, ITE, 1992
    - *Traffic Planning Handbook*, ITE, 1992
    - *Synchro 4.0* Software, distributed by Trafficware
    - *SimTraffic* Software, distributed by Trafficware

- *MTMCTEA Pamphlet 55-10, Traffic Engineering for Better Roads,* 1985
- *MTMCTEA Pamphlet 55-14, Traffic Engineering for Better Signs and Markings,* 1985
- *MTMCTEA Pamphlet 55-17, Better Military Traffic Engineering,* 1987
- *Manual on Identification, Analysis and Correction of High Accident Locations,* FHWA, 1975
- *Highway Safety Design and Operations Guide,* AASHTO, 1997

Traffic volumes and lane configurations were used in HCS to determine intersection levels of service (LOS). LOS describes the operational condition of an intersection and usually falls into one of six categories, A through F. LOS A represents the best operating conditions and LOS F represents the worst condition. LOS E is the value that corresponds to the capacity of a facility where delays become intolerable and queues begin to form. Generally, a facility operating at or better than LOS D is considered acceptable. Appendix A details and graphically shows examples and definitions of LOS A through F. Appendix B provides peak-hour LOS summaries for the study intersections.

4. ***Recommendations*** - From the crash reports, traffic volumes, LOS, and field observations, recommendations were developed for each location studied.

   It should be noted that MTMCTEA publicizes highway safety because of the many deaths and injuries that occur on military installations each year. Highway crashes and their severity are caused by one or more of the highway system elements: the roadway, the vehicle, and/or the driver. Many times, law enforcement officials tend to blame crashes directly on the driver. Even if the driver was at fault, did the road or roadside environment contribute to the severity of injuries or property damage costs? Too often the driver takes the blame, while other causative factors remain hidden. The driver is expected to compensate for inadequate highway design and control measures in his/her driving tasks. Transportation engineers know a definite correlation exists between crashes or crash severity and substandard design or inadequate control measures. Crash causes and their destruction intensity must be clearly defined and related to the highway system elements.

   Often fatal and serious injury crashes occur because motorists impact highway hazards. Even though the crash cause is listed as driver error such as running off the road, speeding, driving under the influence (medicinal drugs), driving while intoxicated, falling asleep, etc., there are contributory factors surrounding a crash that affect the severity. In other words, the highway features are not forgiving or crashworthy. In the case of traffic control devices, they may be unnecessary, non-standard, or confusing.

Montgomery Gate & the Intersection of Derenne Avenue with Montgomery Street

Existing Conditions:

MONTGOMERY GATE

- ***Lane Configuration:*** Two-lanes inbound and two-lanes outbound. Two-lanes inbound restricted to one inbound lane due to manpower requirements.
- ***Hours of Operation:*** Open 0500 hour to 2100 hours.
- ***Street Lighting***: Two luminaires, one over inbound traffic, one over outbound traffic.
- ***Hazards:*** Intersecting roadways on both sides of gate (Internal - Perimeter Road and Middle Ground Road. External – Mildred Street and Hampstead Avenue). Hidden STOP sign on Mildred Street.
- ***Daily Traffic***: Inbound 3,838 vehicles, outbound 4,039 vehicles, total 7,877 vehicles.
- ***Morning Peak Hour Traffic:*** Inbound 482 vehicles, outbound 278 vehicles.
- ***Mid-day Peak Hour Traffic:*** Inbound 385 vehicles, outbound 519 vehicles.

Figure 1. Northward view of Mildred Street

Figure 2. Blocked STOP sign along Mildred Street (southward view)

- ***Evening Peak Hour Traffic:*** Inbound 276 vehicles, outbound 549 vehicles.

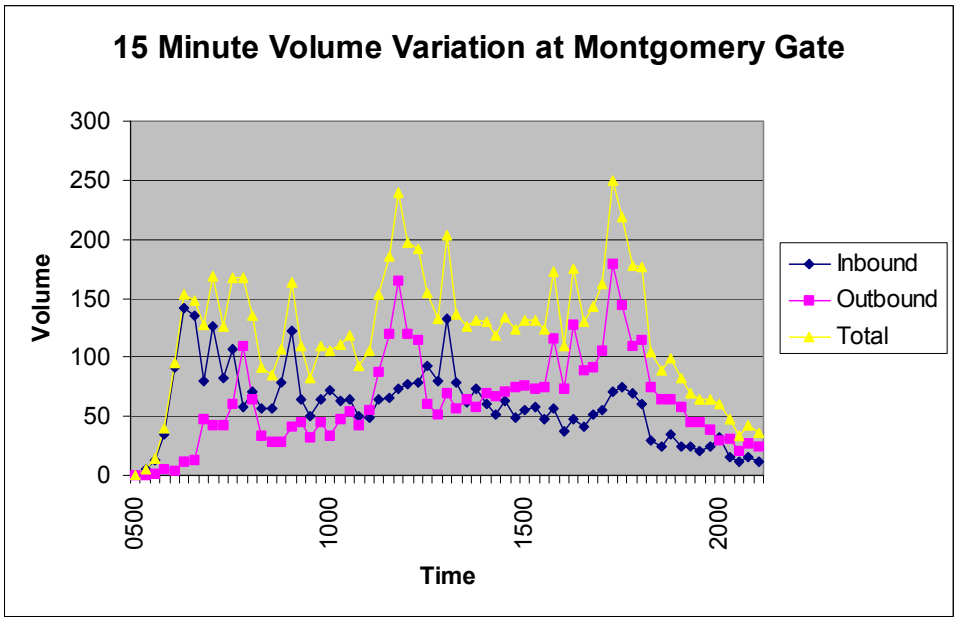


Figure 3. Volume variation at Montgomery Gate

INTERSECTION OF DERENNE AVENUE WITH MONTGOMERY STREET

- ***Control:*** Six-phase actuated traffic signal, protected left-turns on Derenne Avenue and split-phasing on Montgomery Street.
- ***Speed Limit:*** 45 mph on Derenne Avenue, 35 mph NB on Montgomery Street, 40 mph SB on Montgomery Street.
- ***Hazards:*** Narrow (8' 3") lanes (westbound through/right, westbound left, eastbound through/right, and eastbound left). Both westbound and eastbound right-turn movements are provided with protected right-turn phasing from a shared lane.

Figure 4. Intersection of Derenne Avenue with Montgomery Street (northward view)

- ***Sight-distance Restrictions:*** None.
- ***Street Lighting:*** East side of Montgomery Street.

- ***Morning Peak Hour Traffic:*** Total intersection volume of 4,547 vehicles (refer to fig 6 for turning movement counts).

- ***Mid-day Peak Hour Traffic:*** Total intersection volume of 4,211 vehicles (refer to fig 6 for turning movement counts).

- ***Evening Peak Hour Traffic:*** Total intersection volume of 5,509 vehicles (refer to fig 6 for turning movement counts).

Figure 5. Intersection of Derenne Avenue with Montgomery Street (southward view)

- ***Pedestrian Level:*** Minimal at time of data collection (less than 2 per hour).

- ***Restrictions:*** "No Turn on Red" on northbound and southbound approaches. "No U-turn on southbound approach.

- ***Crash History (1/1/97 through 12/31/99):***
  197 total crashes resulting in 66 injured persons
  55.4% rear-end crashes
  22.8% sideswipe crashes
  15.2% angle crashes
  6.6 % miscellaneous crashes
  21.3% crashes resulted in at least one injury

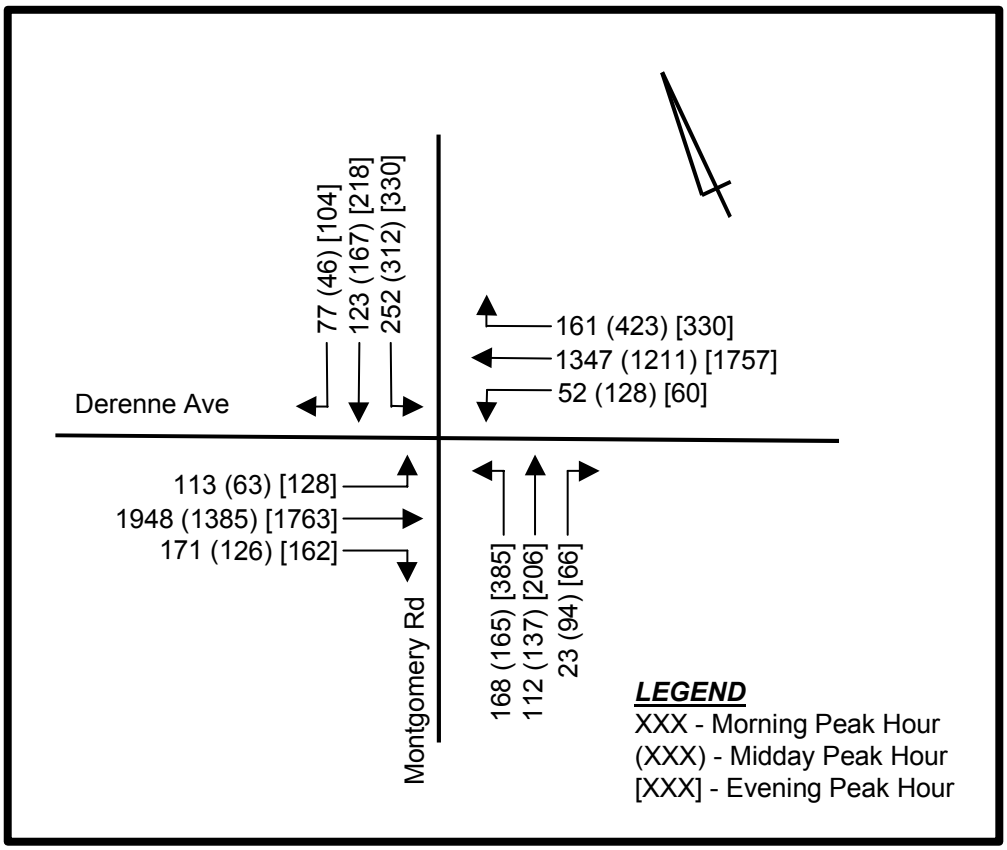


Figure 6. Peak hour traffic volumes at the intersection of Derenne Avenue with Montgomery Street

Discussion and Recommendations:

The south leg of Montgomery Street at its intersection with Derenne Avenue provides access to Hunter Army Airfield. The gate to the installation is approximately ½ mile south of the intersection.

Intersection Traffic Operations

Intersection operation was analyzed using *Synchro* and *SimTraffic Software*. Appendix B provides results of the analyses.

During the PM peak hour the intersection operates at LOS D, which is considered acceptable under urban conditions. Although some drivers may experience a considerable amount of delay at this intersection, Derenne Avenue consists of three through lanes in each direction and handles a large volume of traffic. When the delay is averaged over the entire volume of traffic that enters the intersection, the resulting per vehicle delay is acceptable. Because this signal is on a system it is also affected by upstream and downstream signals but does seem to operate efficiently based on field

operations and traffic analyses. Field observation does indicate the following safety problems:

- The southwest corner turning radius is tight and several trucks ran over the curb in this area. Military trucks among others must execute this turn very slowly, causing through vehicles behind them to also slow down.
- Red light running at this intersection is a very serious problem. During all peak periods blatant red light running was observed, sometimes by as much as 5 seconds after the red interval begins. Short clearance intervals further complicate this situation.
- The eastbound and westbound approaches consist of shared through-right turn lanes. A right-turn overlap phase is provided for these right turns. This type of phasing is not recommended with shared lanes because of the increased rear-end crash potential that results. When a through vehicle is waiting during the right-turn overlap phase and a right-turning vehicle approaches from behind the driver may only notice the green arrow indication and not the through vehicle waiting in the lane.
- Eastbound queues often extend from the signalized intersection of White Bluff Road with Derenne Avenue. Drivers heading eastbound coming from I-516 often enter the intersection at Montgomery Street even with these queues present and block the subsequent northbound phase.
- We observed vehicles ignoring the shoulder-mounted “NO TURN ON RED” sign on northbound Montgomery approach at Derenne. Motorists are looking up at the signal face, to the left, and into the intersection for clearance gaps and not to the right until they pass the sign when making a final check for any pedestrians.

Intersection Improvements

To address the safety concerns listed previously, the following improvements are recommended:

- Increase the southwest corner turning radius.
- Widen the 8'-3" narrow lane widths for the eastbound and westbound shared thru-right movement to the standard width of 12'-0". These narrow widths decrease the capacity of each lane by approximately 15 percent (based on HCM capacity reduction factors) compared to that of a standard 12-foot lane. In addition, this narrow width allows drivers little room for error.
- Increase the Yellow + All Red (Y+AR) clearance interval for Derenne Avenue. Calculations show the current total of 5.0 seconds (4.0 Y, 1.0 AR) to be sufficient; however, increasing the all-red component may reduce some of the angle and rear-end crashes caused by red light running attempts. Because Derenne Avenue is a highly congested corridor, driver impatience is common and a probable factor in red light running. The high percentage of rear-end crashes at this intersection may be attributed to red light running drivers anticipating that the preceding vehicle will enter the intersection when they instead stop.

- Red light running violations can also be reduced through better enforcement. This intersection would be an excellent candidate for Red Light Cameras, which have been used successfully in states such as Virginia, Maryland, and Delaware.
- Remove the Right Turn Overlap phase and associated signal indications.
- The City of New York has implemented a program to greatly reduce the problem of blocking intersections. The area where blockage is prohibited is boxed out with heavy pavement markings and signs are placed that read, “Do Not Block The Box”. Fines result if drivers are within this box when they are faced with a red indication. This may be a solution at the Derenne Avenue/Montgomery Street intersection. This is particularly a problem at this location because of the constant free-flow volume entering the intersection coming off of I-516. At a minimum, the standard MUTCD sign (R10-7), "DO NOT BLOCK INTERSECTION" should be used.
- Remove the shoulder-mounted “No Turn on Red” sign and install a span-mounted “No Turn on Red” sign near the applicable traffic signal face on the northbound Montgomery approach.

Gate Area Traffic Operations

The Montgomery Gate is in proximity to several streets that drivers often use as a shortcut to avoid portions of Derenne Avenue and Abercorn Street. This cut-thru traffic often conflicts with inbound and outbound gate traffic. Inbound Hunter Army Airfield traffic is also part of this cut-thru traffic. The various cut-thru movements along with their associated safety and operational concerns are listed below:

- *Mildred Street as an access from Derenne Avenue to HAAF:*
  Mildred Street is a dirt road that connects Derenne Avenue with Montgomery Street immediately outside from the gate. Drivers sometimes use this road as a shortcut to access the Montgomery Gate from Derenne Avenue. Because Mildred Street intersects Montgomery Street only 20 feet from the gate, it is difficult for these cut-thru vehicles to enter Montgomery Street when two or more vehicles are waiting to enter the installation. Another concern with this intersection is the STOP sign on Mildred Street that is completely obstructed by vegetation (see fig 2).

- *Mildred Street as a shortcut to White Bluff Road and points south and east:*
  Some drivers use Mildred Street and cross the median just outside the gate in order to proceed to Hampstead Avenue then on to White Bluff Road. Drivers stop within this median and must yield to outbound gate traffic. Sight distance is restricted because of the gatehouse.

- *Montgomery Street as a shortcut to/from White Bluff Road and points south and east:*
  Traffic on eastbound Derenne Avenue sometimes diverts onto Montgomery Street then to Hampstead Avenue and White Bluff Road to avoid the congested portions of Derenne Avenue and Abercorn Street. This traffic makes a hard left to cross the Montgomery Street median and to access Hampstead Avenue. Conflicts sometimes occur between these vehicles and the few vehicles that also use Hampstead Avenue

and turn left at Montgomery Street to access HAAF. Traffic also diverts from White Bluff Road onto Hampstead Avenue, to Montgomery Street, and then to Derenne Avenue.

Gate Area Improvements

- *Short Term:*
  Because of the congested conditions of the surrounding roadway network, drivers seek alternative routes such as those described above. Some of these do not directly affect the gate traffic and there is little to do to prevent them especially since drivers will likely find other alternatives. Traffic that does have a direct effect on gate operations is the shortcut from Mildred Street to Hampstead Avenue. To prevent this, installing a directional slip median in front of the gate is recommended. Drivers southbound on Montgomery Street could still use this median opening to turn left and prevent accidental access to HAAF; however, traffic from Mildred Street would not be able to go straight. At Birchfield Street, the last intersection with Mildred Street, signing that reads "*HAAF AND LOCAL TRAFFIC ONLY*" would reduce the potential for thru-traffic. Those who accidentally find themselves on Mildred Street at its intersection with Montgomery Street would have to enter the installation to turn around, but signing as referred to above should keep this to a minimum.

  Trimming of vegetation is required to allow full visibility of the STOP sign on Mildred Street.

- *Long Term:*
  A relocation of the gate is recommended as a long-term improvement. A detailed discussion is provided in the section, *Long Term Recommendations*.

Wilson Gate & the Intersection of White Bluff Road with Stephenson Avenue

Existing Conditions:

WILSON GATE

- ***Lane Configuration:*** Two-lanes inbound and two-lanes outbound. Two-lanes inbound restricted to one inbound lane due to manpower requirements.
- ***Hours of Operation:*** 24-hour
- ***Street Lighting***: Two luminaires, one over inbound traffic, one over outbound traffic.
- ***Hazards:*** None.
- ***Daily Traffic***: Inbound 5,756 vehicles, outbound 5,601 vehicles, total 11,357 vehicles.
- ***Morning Peak Hour Traffic:*** Inbound 593 vehicles, outbound 309 vehicles.
- ***Mid-day Peak Hour Traffic:*** Inbound 673 vehicles, outbound 680 vehicles.
- ***Evening Peak Hour Traffic:*** Inbound 325 vehicles, outbound 669 vehicles.

Figure 7. Wilson Gate (westward view)

Figure 8. Wilson Gate inbound lanes (westward view)

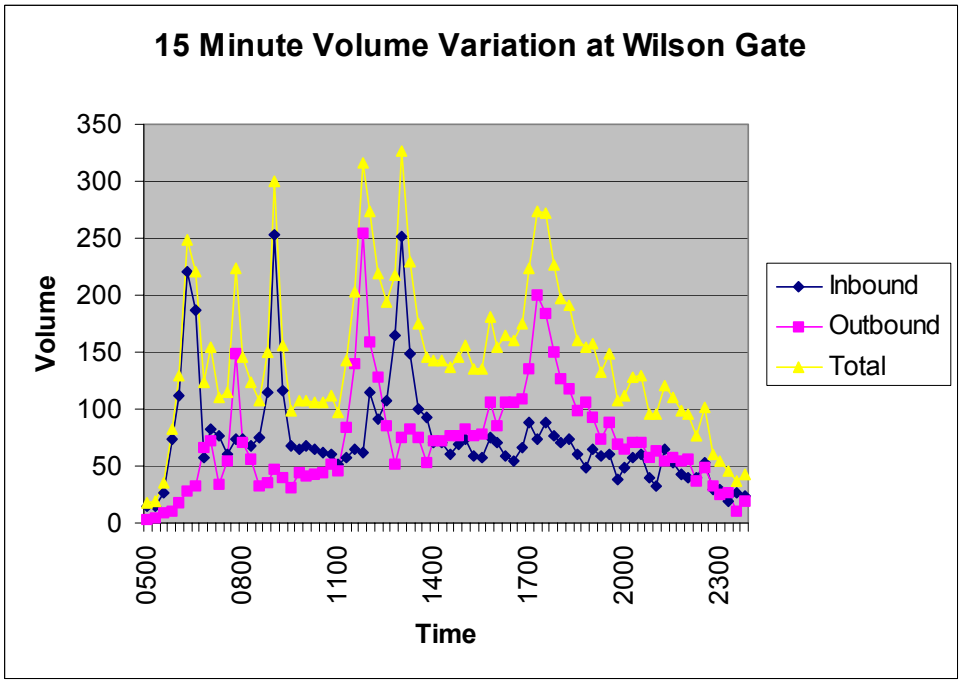


Figure 9. Volume variation at Wilson Gate

INTERSECTION OF WHITE BLUFF ROAD WITH STEPHENSON AVENUE

- ***Control:*** Five-phase actuated traffic signal, protected left-turns on White Bluff Road and one-phase for all Stephenson Avenue traffic.
- ***Speed Limit:*** 40 mph on White Bluff Road, 20 mph near Wilson Gate.
- ***Hazards:*** Geometry and one-phase operation along Stephenson Avenue results in unsafe conditions.
- ***Sight-distance Restrictions:*** Eastbound traffic has limited sight distance due to HAAF wall.

Figure 10. Intersection of White Bluff Road with Stephenson Avenue (westward view)

- ***Street Lighting:*** East side of White Bluff Road.

- ***Morning Peak Hour Traffic:*** Total intersection volume of 3,540 vehicles (refer to fig 11 for turning movement counts).

- ***Mid-day Peak Hour Traffic:*** Total intersection volume of 3,914 vehicles (refer to fig 11 for turning movement counts).

- ***Evening Peak Hour Traffic:*** Total intersection volume of 4,063 vehicles (refer to fig 11 for turning movement counts).

- ***Pedestrian Level:*** None observed.

- ***Restrictions:*** None.

- ***Crash History (1/1/97 through 12/31/99):***
  142 total crashes resulting in 36 injured persons
  66.2% rear-end crashes
  4.9% sideswipe crashes
  19.7% angle crashes
  9.2% miscellaneous crashes
  15.5% crashes resulted in at least one injury

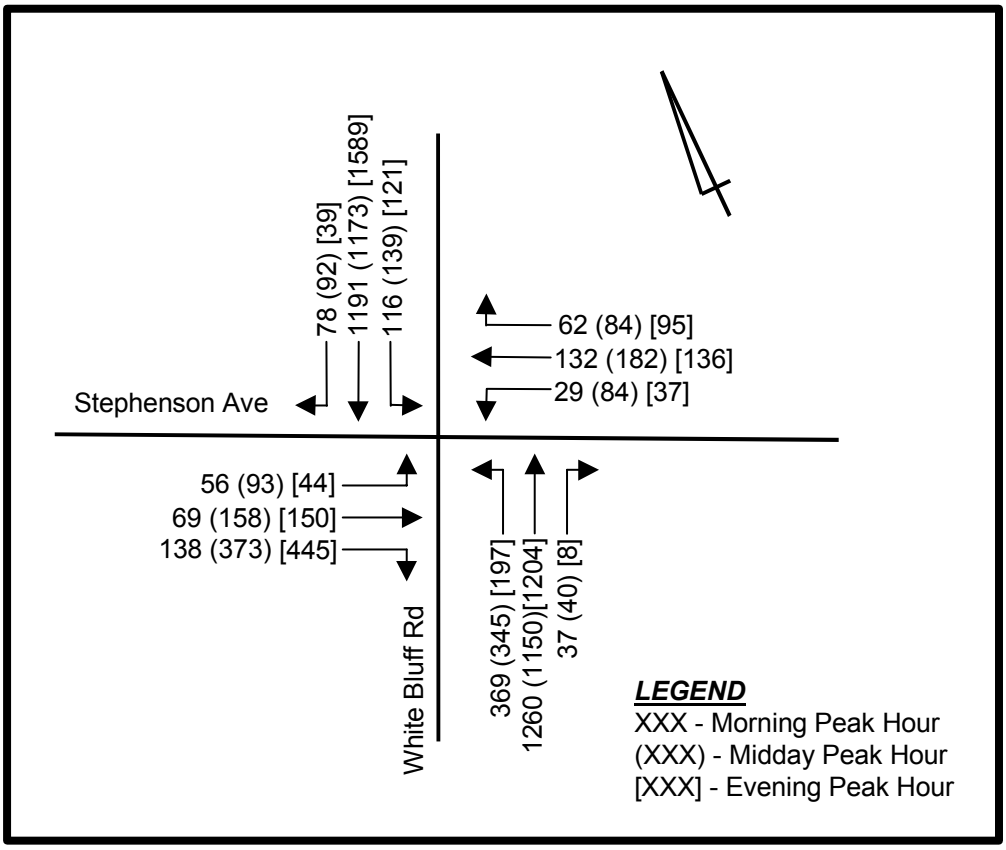


Figure 11. Peak hour traffic volumes at the intersection of White Bluff Road with Stephenson Avenue

Discussion and Recommendations:

The west leg of the White Bluff Road and Stephenson Avenue intersection forms the main access to Hunter Army Airfield. The gate to the installation is approximately 800 feet west of the intersection.

Traffic Operations

Intersection operation was analyzed using *Synchro* and *SimTraffic Software* since *HCS Software* cannot provide measures of delay when LOS F is reached and delay levels exceed certain values. Appendix B provides results of the analyses.

Numerous conflicts were observed during peak period field observations. The east-west movements operate with concurrent signal phasing. Because of the heavy eastbound right-turn movement exiting the base, primarily during midday and evening peak periods, it is very difficult for the westbound left-turn movement to safely enter southbound White Bluff Road. Unsafe movements observed were:

- East-west left-turning vehicles turning around each other rather than to the inside of each other.
- Westbound left-turning vehicles often pass one another in the middle of the intersection due to impatience and indecision associated with conflicts with eastbound right-turn movements.
- Westbound lefts turning simultaneously with eastbound rights and entering the leftmost lane of southbound White Bluff Road assume the rights will use the rightmost lane.
- Southbound U-turns conflicting with the westbound right-turn-on-red movement.
- Improper lane usage such as a through movement from the eastbound right-turn only lane.

Figure 12. Intersection of White Bluff Road with Stephenson Avenue (southwestward view)

Intersection Improvements

During the PM peak hour, the intersection operates at LOS F. Improving this LOS would require additional through-lanes on White Bluff Road, which would be very costly. The widening would have to be carried out along most of the corridor's length and major tree removal, resulting in environmental issues, would be needed.

As recommended at Derenne and Montgomery, the red component of the Y+AR clearance interval should be increased. As previously discussed, this may be a factor in the high number of rear-end crashes.

Although difficult to address the capacity problems at the intersection, there are improvements that can be implemented to address the safety concerns listed previously:

- Add split phasing for Stephenson Avenue with appropriate left and right arrow signal indications. This would not decrease the LOS at the intersection and would eliminate many of the conflicts previously noted. Left turns would enter White Bluff Road during a protected signal phase.
- Install an R3-4 "No U-Turn (SYMBOL)" sign on the northbound and southbound approaches. This would allow eastbound and westbound right turns to proceed on red without conflict.
- Install Lane Use Control signs on both the eastbound and westbound approaches. A sign such as the one at right would be used, although the arrow configuration would differ. Although pavement markings were adequately visible, these signs assist drivers with the proper lane usage when markings are worn or not clearly visible during nighttime or wet conditions.

Rio Road Gate & the Intersection of Abercorn Street with Rio Road

Existing Conditions:

RIO GATE

Figure 13. Rio Gate (westward view)

- ***Lane Configuration:*** One-lane inbound and one-lane outbound. Restricted hours.
- ***Hours of Operation:*** Open Monday – Thursday 0530 hour to 0930 hours, 1630 hours to 1830 hours. Open Friday 0530 hour to 0930 hours, 1500 hours to 1700 hours. Open Saturday and Sunday 0700 hours to 1800 hours.
- ***Street Lighting***: None.
- ***Hazards:*** None for current and future light usage.

- ***Daily Traffic***: Inbound 663 vehicles, outbound 415 vehicles, total 1,078 vehicles.
- ***Morning Peak Hour Traffic:*** Inbound 174 vehicles, outbound 81 vehicles.
- ***Evening Peak Hour Traffic:*** Inbound 33 vehicles, outbound 83 vehicles.

INTERSECTION OF ABERCORN STREET WITH RIO ROAD

- ***Control:*** Eight-phase actuated traffic signal, protected left-turns on Abercorn Street, protected/permitted left-turns on Rio Road. All right-turn lanes are yield controlled.
- ***Speed Limit:*** 45 mph on Abercorn Street.
- ***Hazards:*** None.
- ***Sight-distance Restrictions:*** None.
- ***Street Lighting:*** All quadrants.
- ***Morning Peak Hour Traffic:*** Total intersection volume of 3,225 vehicles (refer to fig 16 for turning movement counts).
- ***Mid-day Peak Hour Traffic:*** Total intersection volume of 3,467 vehicles (refer to fig 16 for turning movement counts).
- ***Evening Peak Hour Traffic:*** Total intersection volume of 4,515 vehicles (refer to fig 16 for turning movement counts).
- ***Pedestrian Level:*** None.
- ***Restrictions:*** None.

Figure 14. Intersection of Abercorn Street with Rio Road (northward view)

Figure 15. Intersection of Abercorn Street with Rio Road (westward view)

- ***Crash History (1/1/97 through 12/31/99):***
  224 total crashes resulting in 70 injured persons
  66.1% rear-end crashes
  8.5% sideswipe crashes
  19.6% angle crashes
  5.8% miscellaneous crashes
  19.6% crashes resulted in at least one injury

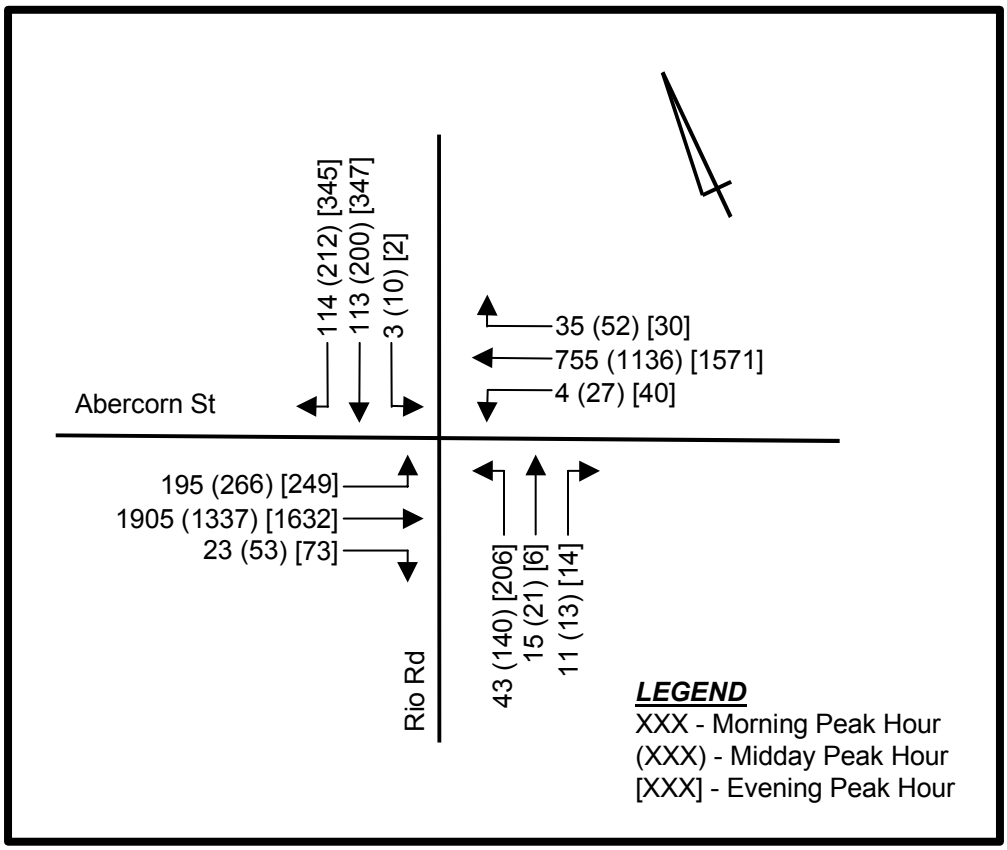


Figure 16. Peak hour traffic volumes at the intersection of Abercorn Street with Rio Road

Discussion and Recommendations:

The north leg of Rio Road at its intersection with Abercorn Street provides access to Hunter Army Airfield via the Rio Road gate. The gate to the installation is approximately ¼ mile north of the intersection.

Intersection Traffic Operations

Intersection operation was analyzed using *Synchro* and *SimTraffic Software*. Appendix B provides results of the analyses.

The intersection operates acceptably during AM and midday peak hours but operates at an unsatisfactory LOS E during the PM peak hour. This poor LOS results because of the high volume of through traffic on Abercorn Street. This intersection appears to be relatively new and field observation does not indicate any safety problems. The high number of rear-end crashes at this intersection are likely attributable to speeds and drivers following too closely. The wide-open nature of the Abercorn Street roadside in combination with the downgrade coming from the west contributes to these higher speeds.

Intersection Improvements

As recommended at the other gate intersections, the red component of the Y+AR clearance interval should be increased. As previously discussed, this may be a factor in the high number of rear-end crashes.

Gate Area Traffic Operations

The Rio Road gate is not open to traffic on a full-time basis and handles low volume. The only evident problem operationally is its proximity to Rio Road. Storage for only several vehicles is available between the gate and Rio Road.

Gate Area Improvements

- *Short Term:*
  The Rio Road gate handles low traffic volume and is only open to traffic part time. This operation seems to be working effectively.

- *Long Term:*
  Slight gate realignment and electronic gate access are recommended in the long term. This is described in detail under the section *Long Term Gate Improvements.*

Long-Term Considerations and Recommendations

Considerations:

AREA GROWTH AND DEVELOPMENT

Based on conversations with the Metropolitan Planning Commission, it is anticipated that the Abercorn Corridor will experience greater than 2.5% per year increases in traffic volumes through year 2015. This increase in traffic levels will worsen the already congested roadway network located to the east of HAAF.

The extension of the Harry S. Truman Parkway from Derenne Avenue through Abercorn Street in the vicinity of Windsor Forest should alleviate some congestion from the Abercorn Corridor. However, due to the many commercial and residential properties, it is anticipated that Abercorn Street will still experience operational deficiencies.

The high traffic volumes and corresponding congestion result in high crash rates at the intersections immediately adjacent to HAAF gates as mentioned previously.

DEPLOYMENT

The deployment of manpower and supplies from Fort Stewart (Hinesville, GA) to HAAF is a critical link in troop readiness. Currently, 2000 to 3000 soldiers are mobilized from Fort Stewart to HAAF every other week. A typical deployment involves 20+ buses and trucks. At times of high military alert, troop deployment is more frequent.

Larger equipment and supplies are shipped via rail. Ammunition from Fort Stewart to HAAF is typically routed through Rio Gate to avoid Abercorn Street. Personnel are routed through Montgomery and Rio Gates.

The normal deployment route follows GA Route 144 to I-95 to GA Route 204. A decision point occurs at the intersection of GA Route 204 and Veteran Parkway. Vehicles using Montgomery Gate access HAAF via Veterans Parkway and I-516/Derenne Avenue. Vehicles using Rio Gate access HAAF via the intersection of Abercorn Street and Rio Road.

HUNTER ARMY AIRFIELD PLANNED IMPROVEMENTS

The proposed Sabre Hall Ranger Complex to be located near Hallstrom Lake, which is south of the airfield, will serve a population of approximately 480.

The complex will include:
- Barracks (149,760 SF)
- Community Center (25,656 SF)
- Dining Hall (17,000 SF)
- Operation Facility (45,555 SF)

- Battalion HQ (20,785 SF)
- Other supporting facilities

The Sabre Hall complex is expected to increase traffic at the southern end of the installation. The complex may generate additional traffic through the Rio Gate.

MIDDLEGROUND ROAD WIDENING

There are plans to widen Middleground Road/Montgomery Cross, from Abercorn Street in the vicinity of Armstrong Atlantic State University through Abercorn Street in the vicinity of Hunter Golf Course, from two to four lanes sometime after year 2003. The roadway widening will improve the corridor used to gain access to residential developments and commercial properties such as Savannah Mall. Additionally, Middleground Road is used by some to avoid congestion on Abercorn Street.

Part of the proposed widening may include the addition of a HAAF gate at Tibet Road. At the time of this study, details of a proposed Tibet Road Gate were not available.

MANPOWER

With increased manpower constraints, HAAF does not have the staff available to control additional access points. At the present time Wilson Gate has 24-hour operation and Montgomery and Rio Gates have limited operation. Gates with two inbound lanes (Wilson and Montgomery) have been reduced to one-lane gates with traffic control devices due to manpower constraints.

Recommendations:

ACCESS ALTERNATIVES

Based on traffic levels and congestion along the Abercorn and Derenne corridors, a western gate should be considered. A new access will provide safer, more efficient and more direct access to HAAF. Both HAAF and the City of Savannah would benefit from such an improvement.

Analysis of Alternatives

Based on conversations with HAAF officials, three alternatives were evaluated for their feasibility as access Alternatives to HAAF.

Alternative 1 – I-516 at Douglas Street.
Alternative 2 – Veterans Parkway approximately 2-3 miles north of GA 204.
Alternative 3 – Derenne Avenue at Perimeter Road/Mildred Street.

Alternative 1 – I-516 at Douglas Street

Alternative 1 would involve interchange access from I-516 to Douglas Street on HAAF. This connection would provide direct access from I-516 to the airfield via Douglas Street. It is estimated that vehicles arriving from the west would experience a 2-minute timesavings under Alternative 1 versus the existing route.

Figure 17. I-516 near Douglas Street (westward view)

Mapping indicates that the proposed location is approximately 0.85 miles east of the interchange of I-516 and Veterans Parkway. This distance is from the center of the interchange to the existing location of Douglas Street. The interchange could not be moved further east due to conflicts with the motor pool area near Mitchell Boulevard and residential neighborhoods to the north of I-516. AASHTO recommends at least one mile between interstate interchanges in urban areas.

Figure 18. Douglas Street (northward view)

The elevations of I-516 and Douglas Street would create significant design and construction challenges due to an approximately 25-foot difference in elevation of the two roadways. Additionally, the proximity of the Seaboard Coast Line Railroad would create other design challenges that would impact the cost of the interchange. Environmental impacts would include the wooded area to the north of I-516 as well as possible impacts to West Lake Park. The wooded area represents a greater elevation change than that of Douglas Street to I-516. A cost estimate of $21.6 million for design and construction was arrived at using the conceptual plan layout provided in figure 19. It should be emphasized that the estimate is for feasibility only. Cost estimates do not include any detailed engineering and may require revision during design. Cost items and details are provided in Appendix C.

To gain access to an interstate highway, it must be demonstrated to the Federal Highway Administration (FHWA) that:

- The proposed interchange will not impact highway operations,
- Other improvement alternatives do not exist or are not feasible,
- Other roadways will benefit or will not be adversely impacted by the proposed access, and
- The proposed access is in the long-range interest of the community.

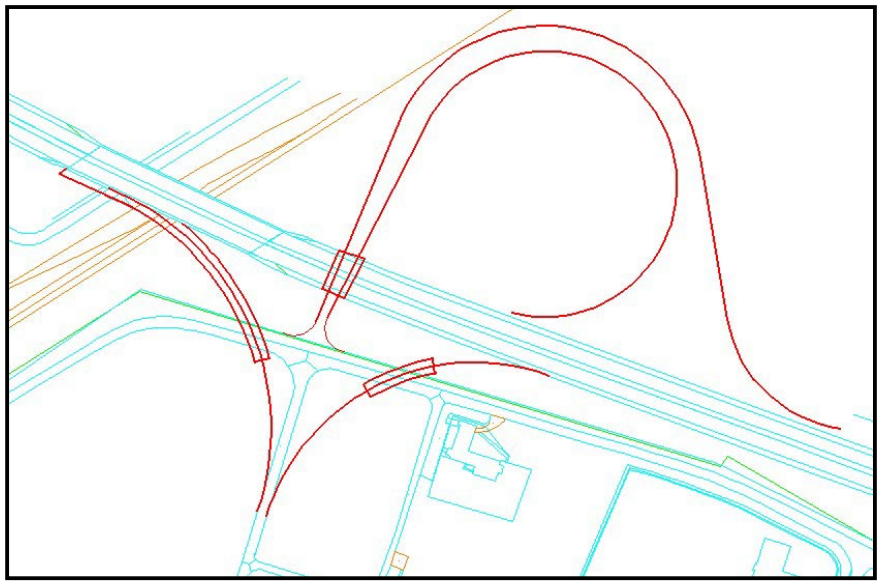


Figure 19. Alternative 1

Figure 20. Alternative 1.A

Based on bullets 3 and 4, Alternative 1 has merit. An evaluation based on bullet 1 is difficult. The spacing from the Veterans Parkway interchange would not meet the AASHTO requirement of 1 mile; however, further study is needed to determine whether the introduction of ramp weaving movements does not have significant impact on the operation of I-516. Based on bullet 4, other alternatives to Alternative 1 do exist as will be discussed in subsequent sections of this study.

Two sub-alternatives to Alternative 1 were developed. Alternative 1.A would be at the same location with access provided to and from the west only. Access to and from the east would be provided at the existing Montgomery Gate. The estimated cost for Alternative 1.A would be $11 million.

Alternative 1.B would be a slip ramp from the west only. The return movement to the west and access to the east would be provided at the existing Montgomery Gate. The estimated cost for Alternative 1.B would be $5.5 million. Both of the sub-alternatives address strategic mobility only.

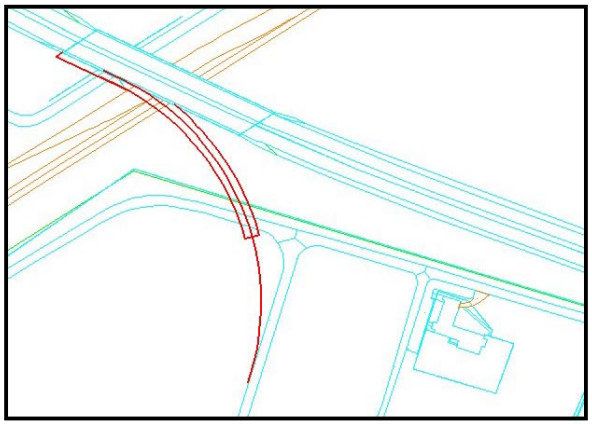


Figure 21. Alternative 1.B

Alternative 2 – Veterans Parkway approximately 2-3 miles north of GA 204

An access to HAAF on the western boundary of the installation would be ideal. However, due to the many design challenges it may not be economically or environmentally feasible.

To gain access from Veterans Parkway, an interchange would be required, a rail line must be crossed and the roadway must go through marshland. However, the alignment is not likely to impact any residential or commercial properties.

Figure 22. Northeastward view from Veterans Parkway towards potential interchange site

Alternative 2 would be the best location for a western gate to

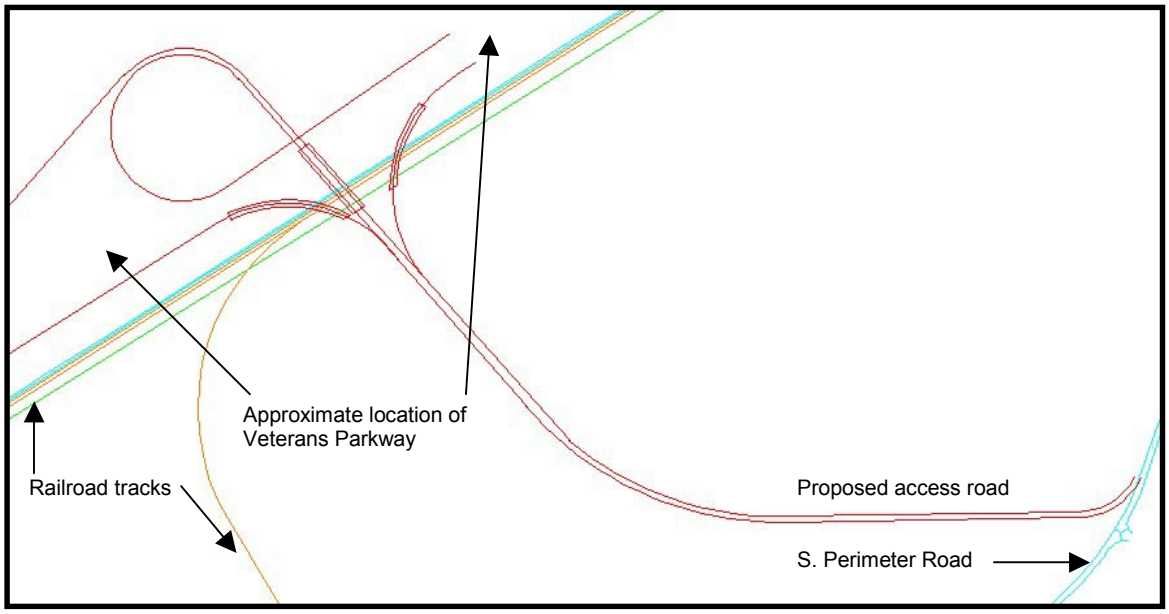


Figure 23. Alternative 2

accommodate vehicle traffic from the southwest area and Fort Stewart.

A cost estimate of $29.6 million for design and construction was arrived at using the conceptual plan layout provided in figure 23. Again, it should be emphasized that the estimate is for feasibility only. Cost estimates do not include any detailed engineering and may require revision during design. Cost items and details are provided in Appendix C.

Alternative 3 – Derenne Avenue at Perimeter Road/Mildred Street

Alternative 3 would be a signalized intersection access along Derenne Avenue in the vicinity of Mildred Street/Herriot Street. The proposed access is in the area where I-516 transitions to Derenne Avenue. Currently a median-divided, at-grade intersection exists at the proposed access point. Perimeter Road parallels Mildred Street south of Derenne Avenue in this area. The proposed widening would stay within the reservation boundary and parallel it for a short distance as shown in figure 24. The overall concept would be to replace the existing Montgomery Gate at a realigned location along Perimeter Road.

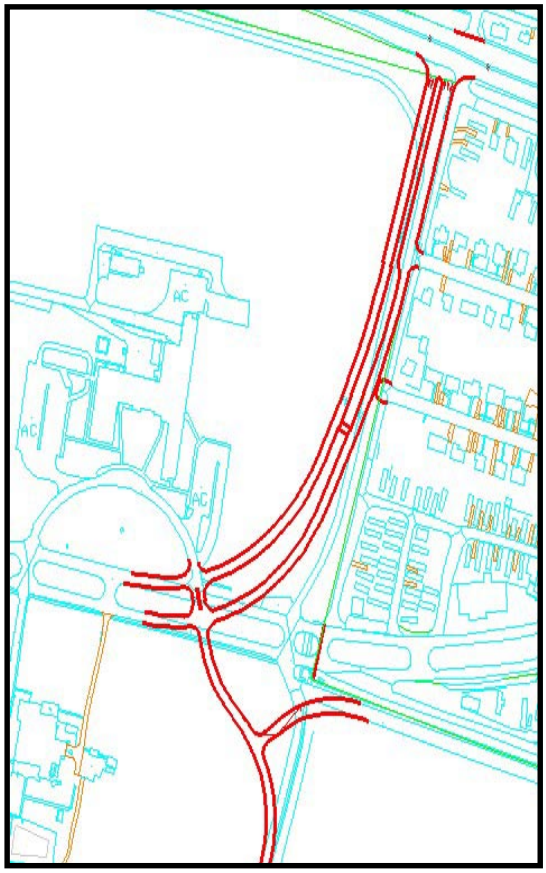


Figure 24. Alternative 3

As can be seen the proposed gate would be located midblock along Perimeter Road between Derenne Avenue and Duncan Drive. This configuration would permit up to 600 feet of queue storage inbound and outbound.

The cost savings of Alternative 3 versus Alternative 1 would be substantial. It is estimated that Alternative would cost $1.4 million. This is $20.2 million less than the cost of constructing Alternative 1.

Based on the anticipated usage, it was calculated that the following lane configuration would be needed at the intersection:

- 1 EB free right-turn
- 3 EB thru lanes
- 1 WB left-turn lane
- 3 WB thru lanes
- 2 NB left-turn lanes
- 1 NB right-turn lane

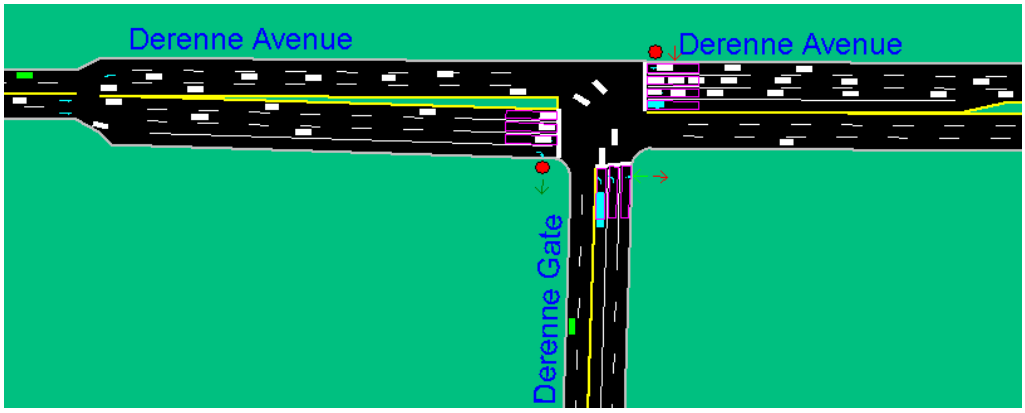


Figure 25. Screen capture of simulation run for Alternative 3

Based on existing traffic volumes, it is expected that the proposed intersection will operate at no worse than LOS B. Figure 25 shows a simulation model of anticipated traffic operations at the proposed intersection. The reserve capacity also allows for future increases in traffic volumes. The intersection of Derenne Avenue and Montgomery Street should improve from LOS D to LOS C during the PM peak hour (worst time period). It is estimated that vehicles arriving from the west would experience a 1-minute timesavings under Alternative 3 versus the existing route.

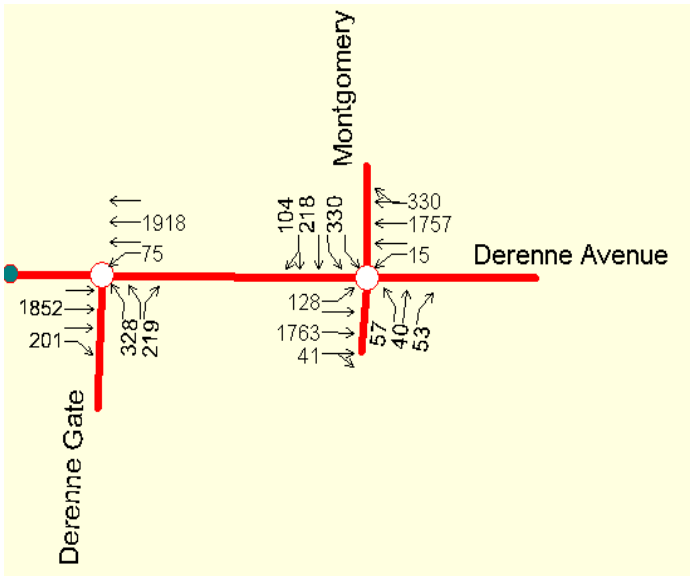


Figure 26. Evening peak hour traffic volumes for Alternative 3

As part of the relocation, the intersection of Duncan Drive, Perimeter Road and Middleground Road should be realigned such that the gate access and Duncan Drive become the mainline and Middleground Road intersects at a 90-degree angle. Due to the lower volumes on Perimeter Road to the east, it is recommended that the roadway be realigned to intersect Middleground Road at a 90-degree angle. Additionally, a cul de sac should be constructed along Perimeter Road in the vicinity of Callaway Circle.

It is recommended that the Mildred Street access to Derenne Avenue be closed. This will benefit residents of Mildred Street and Hampstead Avenue whose bordering streets are used as cut-through roadways to get from Derenne Avenue to White Bluff Road and Abercorn Street.

Additionally, it is recommended that the Herriot Street access to Derenne Avenue be restricted since those movements can be accommodated through the local roadway network.

This alternative, if selected, requires close coordination with City of Savannah. The proposed improvement would permit the City to make operational improvements to Montgomery Street that would benefit area residents. Additionally, splitting the existing intersection volumes to two locations actually improves Derenne Avenue since less side street time is required and progression can be maintained through interconnection of traffic signal equipment. The decreased delay on Derenne Avenue and the elimination of Mildred Street access will decrease the cut-thru traffic via Montgomery Street and Hampstead Street and benefit area residents. Revised traffic volumes at this intersection and at the new gate intersection are depicted in fig. 26.

Future Usage/Needs

As part of this study, an assessment of the future needs of HAAF with regards to access was made. Four locations were considered with regards to future demands while also considering the manpower constraints of HAAF. The four access points considered include:

- Rio Gate – This gate provides the south most access to HAAF. Although vehicular demands are low due to restricted usage, Rio Gate provides an access point with minimal impact to residential and commercial properties due to the location of the intersection of Rio Road and GA Route 204.
- Proposed Tibet Gate – The proposed gate would provide an additional access point to the east. It would serve operations to the south including the proposed Sabre Hall Complex. The proposed gate would likely decrease usage at Wilson Gate and Rio Gate.
- Wilson Gate – This gate serves as the primary commuter access point to HAAF due to its proximity to off-installation residential communities. It also serves as the main access for visitors to HAAF.
- Proposed Derenne Gate (relocated Montgomery Gate) – Existing Montgomery Gate and the proposed Derenne Gate provide access from the west and north via I-516/Derrene Avenue. As discussed earlier, the proposed relocation will make access easier in this direction and will likely attract vehicular traffic from other gates.

Usage at the four locations is dependent of several issues including:

- Hours of operation,
- Origin and destination points internal and external to HAAF, and
- Travel time and delay associated with the local roadway network.

A travel time study was conducted to assist in determining usage at proposed gate locations. A total of six (three in each direction) trial runs were conducted to determine travel time of the surrounding roadway network. For the purposes of this study, travel time runs were conducted on the roadway network of Abercorn Street, Derenne Avenue

and Veterans Parkway. It was assumed that nominal travel time occurs between those roadways and adjacent gates.

Figure 27. Travel time study results

Average Clockwise		Average Counterclockwise	
Montgomery Street	Start	Rio Rd	Start
to White Bluff	0:01:21	to Tibet Ave	0:06:15
to Derenne/Abercorn	0:00:51	to Montg. Cross	0:01:20
to Stephenson/Abercorn	0:01:32	to White Bluff	0:00:50
to White Bluff	0:01:40	to Stephenson/Abercorn	0:01:48
to Montg. Cross	0:00:48	to Derenne/Abercorn	0:01:29
to Tibet Ave	0:01:46	to White Bluff	0:01:02
to Rio Rd	0:05:55	to Montg. Street	0:01:51
to Montg. Street	0:09:55	to Rio Rd	0:10:55
TOTAL	0:23:48	TOTAL	0:25:30

In addition to travel time runs, traffic data collected and supplied by the City of Savannah was used to determine future gate demands. Additionally, conversations with HAAF indicate that commuter traffic originates from the following locations:

- 10% from north and northwest
- 30% from east
- 30% from southeast
- 30% from south and southwest

Based on this information the following conclusions were drawn regarding future usage at the four gate locations.

Figure 28. Future traffic demands at gates

	Existing Daily Traffic	Potential Diversions	Estimated Daily Traffic	Notes
Rio Gate	Inbound 663 Outbound 415 Total 1,078	• Decrease of 10% to Tibet • Decrease of 10% to Derenne	Inbound 531 Outbound 331 Total 862	
Proposed Tibet Gate	N/A	• 10% of Rio traffic (from south) • 30% of Wilson traffic (from south at Wilson)	Inbound 1,793 Outbound 1,722 Total 3,515	
Wilson Gate	Inbound 5,756 Outbound 5,601 Total 11,357	• Decrease of 30% to Tibet	Inbound 4,029 Outbound 3,921 Total 7,950	• 60% of all traffic is from south
Alternative 1 Proposed Douglas Gate	Inbound 3,838 Outbound 4,039 Total 7,877	• 10% of Rio traffic (from south)	Inbound 3,901 Outbound 4,081 Total 7,982	• 46% of existing traffic at Mont. is from west
Alternative 2 Proposed Veterans Parkway Gate		• 100% of Rio traffic (from south) • Montgomery Gate traffic from West	Inbound 1,818 Outbound 2,189 Total 4,007	
Alternative 3 Proposed Derenne Gate	Inbound 3,838 Outbound 4,039 Total 7,877	• 10% of Rio traffic (from south)	Inbound 3,901 Outbound 4,081 Total 7,982	• 46% of existing traffic at Mont. is from west

* *Since Proposed Alternatives 1 and 3 have the same estimated traffic volumes and are the most feasible locations, future traffic volumes for existing locations and the proposed Tibet Gate included demands at Alternatives 1 and 3 and not Alternative 2.*

Recommended Alternative

Benefit-cost ratios were computed which considered crash reductions, travel time differences and construction costs. The following table summarizes each alternative:

Figure 29. Alternatives summary matrix

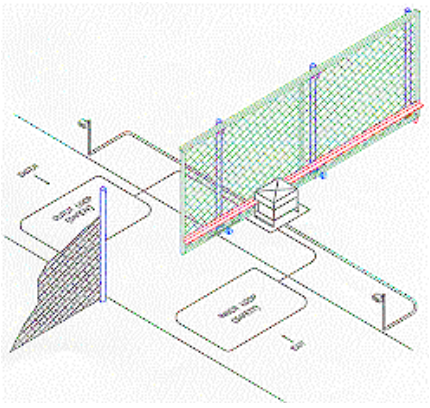
Alternative	Pros	Cons	Estimated Cost (millions)	Benefit-Cost Ratio
1 – I-516 at Douglas Street	✓ Free access to and from I-516. ✓ Direct access to airfield. ✓ Improved traffic operation at intersection of Derenne and Montgomery.	✓ Within 1 mile of existing interchange. ✓ Design challenges including vertical alignment and railroad location.	$21.6	0.19
2 – Veterans Parkway	✓ Free access to and from Veterans Parkway. ✓ Slightly improved traffic operation at intersection of Derenne and Montgomery. ✓ Closest proximity to Ft Stewart.	✓ Likely environmental impacts. ✓ Nearby railroad	$29.6	0.14
3 – Derenne Avenue	✓ Lowest cost. ✓ Improved traffic operations at intersection of Derenne and Montgomery.	✓ Northbound left-turn movement controlled by traffic signal.	$1.4	3.01

All three Alternatives would result in improved traffic operations at the intersection of Derenne and Montgomery. Additionally, military traffic would no longer use Montgomery Street, which also serves residential neighborhoods.

Based on the benefit-cost ratios generated as part of this study, Alternatives 1 and 2 are not justifiable due to the high costs associated with their design and construction. Although the primary drawback of Alternative 3 is that the access point will be a signalized intersection, a benefit-cost ratio of 3.01 results.

AUTOMATED ACCESS

As discussed previously, manpower constraints restrict the ability of HAAF to provide unrestricted access at the existing gates. Both Rio Gate and Montgomery Gate operate with time of day limitations. The possible addition of manned Tibet Gate may not be feasible due to manpower restrictions.



One method to reduce the work force required to man installation gates is to introduce automated gates and fences at some locations. It is estimated that automated access points can process approximately 200 vehicles per hour per lane.

At unmanned locations sliding fences can be installed to allow access to and from HAAF. The gate should be activated for inbound traffic by a card reader and for outbound traffic by an imbedded loop detector. For security purposes, it is suggested that CCTV be installed at all unmanned gates.

At primary access points, it is suggested that both manned and automated lanes be provided for visitors/trucks and those with electronic cards. At manned locations, access can be controlled by gate devices and exit control devices are not required. Overhead signing as illustrated in figure 30 can assist in directing vehicles into the appropriate lanes.

The following provides an estimate of costs associated with automated access. It should be noted that the costs vary significantly depending on manufacturer and other project specifics.

Estimated costs for automated devices:

- Sliding gate - $20,000 each
- Gate for up to a 20' arm - $3,000 each
- Loop detector to close gate after vehicle goes through or to open gate when vehicle exits - $250 each
- Photo eye (prevents closure if beam is broken) - $200 each
- Card reader with gooseneck pad - $1,250 each
- Cards - $3.25 each
- Camera - $6,000 each
- Fiber optic matrix switch - $5,000 total
- Fiber optic modems - $5,000 total
- Fiber optic cable - $1 per linear foot (does not include trenching and conduit)
- Camera control cabinet - $5,000 total
- Video server – $2,000 total
- Video workstation (2 Monitors 21") - $6,000 total
- Video recorder - $2,250 total

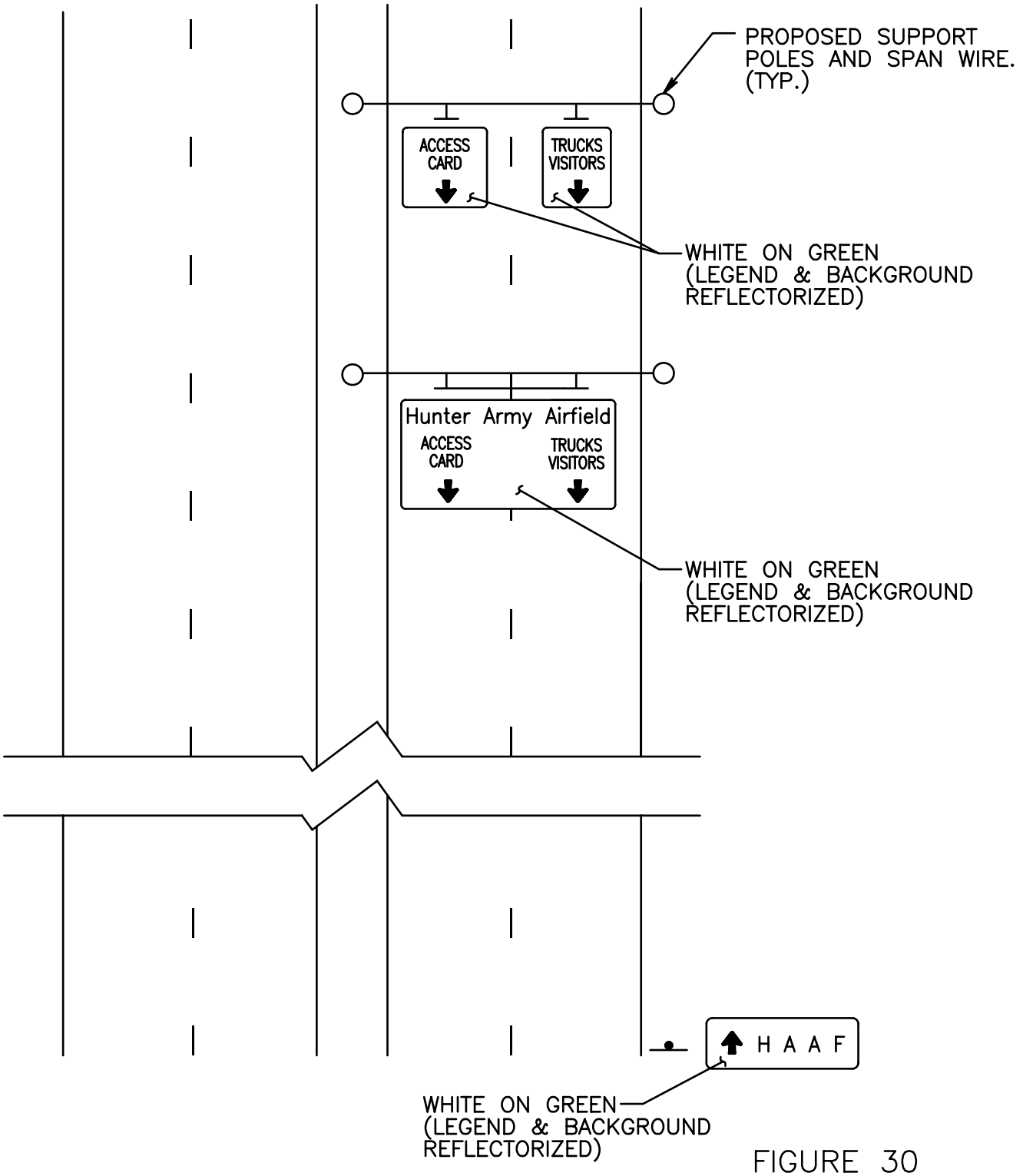


FIGURE 30

PROPOSED WILSON GATE APPROACH SIGNING

Gannett Fleming

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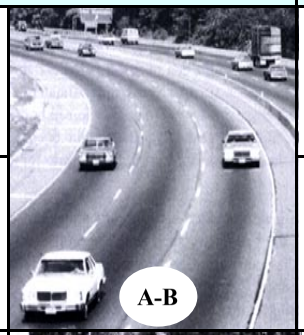
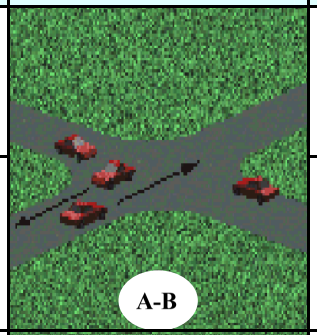
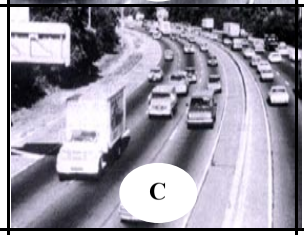
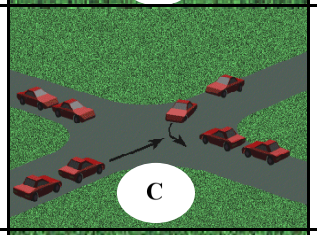
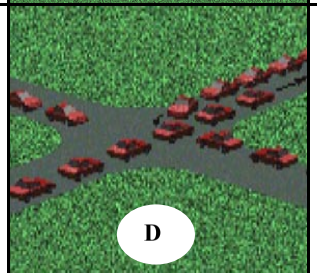
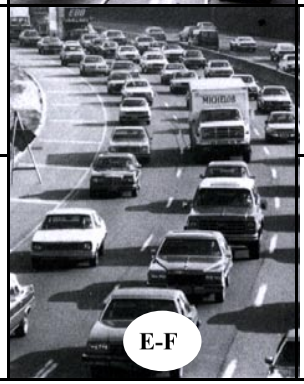
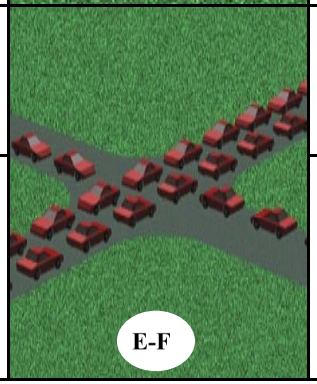
Figure 31. Gate automation summary matrix

Location	Estimated Daily Traffic (in/out/total)	Number of Lanes (per direction)	Type of Control Suggested	Cost of Automated Control
Rio Gate	Inbound 531 Outbound 331 Total 862	One	Automated	$49,000
Proposed Tibet Gate	Inbound1,793 Outbound 1,722 Total 3,515	One	Automated	$49,000
Wilson Gate	Inbound 4,029 Outbound 3,921 Total 7,950	Two	Manned/ Automated	$11,000
Proposed Alternative 1 or 3	Inbound 3,901 Outbound 4,081 Total 7,982	Two	Manned/ Automated	$11,000
Miscellaneous costs of gate automation including fiber optic cable and a surveillance station are expected to cost >$60,000. This cost does not include design and labor as well as system integration or training.				

The estimated cost of implementation is $180,000. The benefit-cost ratio of implementation is 1.35.

Appendix A
Level of Service Definitions

LEVELS OF SERVICE

LOS	ROADWAY SECTIONS		INTERSECTIONS		
			SIGNALIZED		UNSIGNALIZED
A	Free-flow, low traffic density. 90% of free-flow speed.		No vehicle waits longer than one signal cycle. Average stop delay less than 5 sections per vehicle.		Little or no delay. Reserve lane capacity 400 or more passenger cars per hour (Pcph).
B	Delay is not unreasonable. Stable traffic flow. 70% of free-flow speed.		Average stop delay 5 to 15 seconds per vehicle.		Short traffic delays. Reserve lane capacity 300 to 399 Pcph.
C	Stable condition. Movements somewhat restrictive due to higher volumes, but not objectionable to motorists. 50% of free-flow speed.		On a reare occasion motorists wait through more than one signal cycle. Average stop delay 15 to 25 seconds.		Average traffic delays Reserve lane capacity 200 to 299 Pcph.
D	Movements more restricted. Backups and delays may occur during short peaks, but lower demands occur often enough to permit clearing. 40% of free-flow speed.		Delays at intersections may become extensive with some, especially left-turning vehicles, waiting two or more signal indications. Excessive delay not experienced yet. Average stop delay 25 to 40 sec.		Long traffic delays. Reserve lane capacity 100 to 199 Pcph.
E	Roadway conditions and traffic volumes create delay to all motorists. 30% of free-flow speed.		Very long back-ups may create lengthy delays, especially for left-turning vehicles. Average stop delay 40 to 60 sec.		Very long traffic delays. Reserve lane capacity 0 to 99 Pcph.
F	Forced flow with volumes greater than capacity resulting in complete congestion. Less than 30% of free-flow speed.		Arrival rate of traffic exceeds the intersections ability to handle traffic. Unacceptable conditions. Average stop delay exceeds 60 sec per vehicle.		Traffic volumes exceed the lanes ability to handle the traffic.

Appendix B
Levels of Service
By Movement

Intersection Levels of Service (LOS)*

Intersection	Time Period		
	Morning	**Midday**	**Evening**
Derenne Avenue and Montgomery Street			
EB Left	D	D	E
EB Thru/Right	C	C	C
WB Left	E	D	E
WB Thru/Right	C	C	C
NB Left	D	D	F
NB Thru/Right	D	D	E
SB Left	D	D	E
SB Thru/Right	D	D	E
Overall LOS (Seconds Delay)	**C (34.0)**	**C (30.8)**	**D (42.7)**
White Bluff Road and Stephenson Avenue			
EB Left/Thru	C	D	C
EB Right	A	B	C
WB Left/Thru/Right	C	C	B
NB Left	C	D	D
NB Thru/Right	B	C	E
SB Left	D	D	D
SB Thru/Right	B	C	F
Overall LOS (Seconds Delay)	**C (20.1)**	**C (27.1)**	**F (83.6)**
Abercorn Road and Rio Road			
EB Left	B	C	C
EB Thru	C	D	D
WB Left	C	C	D
WB Thru	C	C	D
NB Left	C	D	D
NB Thru	B	B	C
SB Left	D	D	E
SB Thru	B	C	F
Overall LOS (Seconds Delay)	**B (14.9)**	**C (26.0)**	**E (59.2)**

* Because of its inability to calculate delay worse than LOS F conditions, HCS Software was not used. The above operational measures were calculated using Synchro 4 software, Trafficware Corporation

Lanes, Volumes, Timings

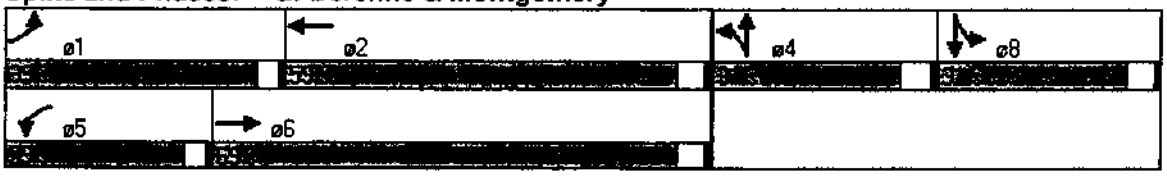
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	160		0	150		0	160		0	130		0
Storage Lanes	1		0	1		0	2		0	2		0
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.91	0.91	1.00	0.91	0.91	0.97	0.95	0.95	0.97	0.95	0.95
Frt Protected		0.988			0.984			0.975			0.942	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	4975	0	1770	5004	0	3367	3384	0	3303	3208	0
Frt Perm.		0.988			0.984			0.975			0.942	
Flt Perm.	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1752	4975	0	1770	5004	0	3367	3384	0	3303	3208	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Volume (vph)	113	1948	171	52	1347	161	168	112	23	252	123	77
Confl. Peds. (#/hr)												
Peak Hour Factor	0.91	0.91	0.91	0.84	0.84	0.84	0.76	0.76	0.76	0.75	0.75	0.75
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	4%	4%	4%	6%	6%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	124	2141	188	62	1604	192	221	147	30	336	164	103
Lane Group Flow (vph)	124	2329	0	62	1796	0	221	177	0	336	267	0
Turn Type	Prot			Prot			Split			Split		
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases												
Detector Phases	1	6		5	2		4	4		8	8	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	39.0	69.0	0.0	29.0	59.0	0.0	31.0	31.0	0.0	31.0	31.0	0.0
Total Split (%)	24%	43%	0%	18%	37%	0%	19%	19%	0%	19%	19%	0%
Maximum Green (s)	35.0	64.0		25.0	54.0		26.0	26.0		26.0	26.0	
Yellow Time (s)	3.0	4.0		3.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None		None	Min		Min	Min		None	None	

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Lane Grp Cap (vph)	210	2699		132	2488		418	420		533	518	
v/s Ratio Prot	0.07	0.47		0.04	0.36		0.07	0.05		0.10	0.08	
v/s Ratio Perm												
Critical LG?	Yes	Yes					Yes			Yes		
Act Effct Green (s)	14.8	67.0		10.6	60.4		15.3	15.3		19.9	19.9	
Actuated g/C Ratio	0.12	0.55		0.09	0.49		0.12	0.12		0.16	0.16	
v/c Ratio	0.58	0.86		0.41	0.73		0.53	0.42		0.63	0.51	
Uniform Delay, d1	51.3	24.2		54.7	24.3		50.6	49.9		48.3	47.3	
Percentile Delay	52.9	31.1		56.4	26.8		51.9	51.3		48.9	48.0	
Percentile LOS	D	C		E	C		D	D		D	D	

Area Type: Other
Cycle Length: 160
Actuated Cycle Length: 122.6
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Total Lost Time: 9
Sum of Critical v/s Ratios: 0.68
Intersection v/c Ratio: 0.73
Intersection Percentile Signal Delay: 34.0
Intersection Percentile LOS: C

Splits and Phases: 2: Derenne & Montgomery



Lanes, Volumes, Timings

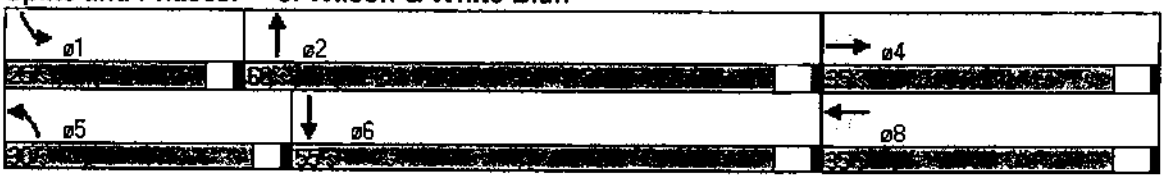
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	200		0	175		0
Storage Lanes	0		1	0		0	2		0	1		0
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50	50	50	50		50	50		50	50	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95	0.97	0.95	0.95	1.00	0.95	0.95
Frt Protected			0.850		0.958			0.996			0.991	
Flt Protected		0.978			0.994		0.950			0.950		
Satd. Flow (prot)	0	1822	1583	0	3370	0	3433	3525	0	1770	3507	0
Frt Perm.			0.850		0.958			0.996			0.991	
Flt Perm.		0.774			0.905		0.950			0.950		
Satd. Flow (perm)	0	1442	1583	0	3068	0	3433	3525	0	1770	3507	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			156		46			3			7	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Volume (vph)	56	69	140	28	132	62	369	1260	37	116	1191	78
Confl. Peds. (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	62	77	156	31	147	69	410	1400	41	129	1323	87
Lane Group Flow (vph)	0	139	156	0	247	0	410	1441	0	129	1410	0
Turn Type	Perm		Perm	Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8								
Detector Phases	4	4	4	8	8		5	2		1	6	
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0		8.0	20.0		8.0	20.0	
Total Split (s)	35.0	35.0	35.0	35.0	35.0	0.0	30.0	60.0	0.0	25.0	55.0	0.0
Total Split (%)	29%	29%	29%	29%	29%	0%	25%	50%	0%	21%	46%	0%
Maximum Green (s)	30.0	30.0	30.0	30.0	30.0		26.0	55.0		21.0	50.0	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None	None	None	None		None	Min		None	Min	

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Lane Grp Cap (vph)		265	418		601		664	2058		222	1811	
v/s Ratio Prot							0.12	0.41		0.07	0.40	
v/s Ratio Perm		0.10	0.07		0.08							
Critical LG?		Yes					Yes				Yes	
Act Effct Green (s)		15.5	15.5		15.5		16.3	49.1		12.4	42.1	
Actuated g/C Ratio		0.19	0.19		0.19		0.19	0.59		0.15	0.50	
v/c Ratio		0.52	0.37		0.41		0.61	0.70		0.50	0.80	
Uniform Delay, d1		30.9	0.0		24.3		30.9	12.2		34.6	16.3	
Percentile Delay		34.8	6.2		26.5		33.3	15.0		37.4	18.8	
Percentile LOS		C	A		C		C	B		D	B	

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 83.6
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Total Lost Time: 9
Sum of Critical v/s Ratios: 0.62
Intersection v/c Ratio: 0.67
Intersection Percentile Signal Delay: 20.1
Intersection Percentile LOS: C

Splits and Phases: 6: Wilson & White Bluff



Lanes, Volumes, Timings

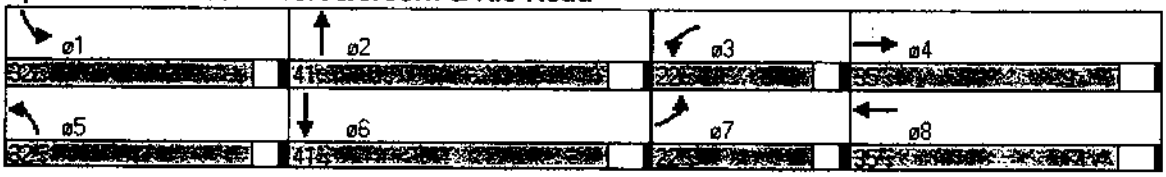
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	200		0	275		0	190		0
Storage Lanes	1		0	1		0	1		0	1		0
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frt Protected												
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1863	0	1770	1863	0	1770	5085	0	1770	5085	0
Frt Perm.												
Flt Perm.	0.746			0.584			0.950			0.950		
Satd. Flow (perm)	1390	1863	0	1088	1863	0	1770	5085	0	1770	5085	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Volume (vph)	3	113	0	43	15	0	195	1905	0	4	755	0
Confl. Peds. (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	3	126	0	48	17	0	217	2117	0	4	839	0
Lane Group Flow (vph)	3	126	0	48	17	0	217	2117	0	4	839	0
Turn Type	Pm+Pt			Pm+Pt			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phases	7	4		3	8		5	2		1	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		8.0	20.0		14.0	20.0	
Total Split (s)	22.0	35.0	0.0	22.0	35.0	0.0	32.0	41.0	0.0	32.0	41.0	0.0
Total Split (%)	17%	27%	0%	17%	27%	0%	25%	32%	0%	25%	32%	0%
Maximum Green (s)	18.0	30.0		18.0	30.0		28.0	36.0		28.0	36.0	
Yellow Time (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None		None	None		None	Min		None	Min	

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Lane Grp Cap (vph)	444	306		192	116		327	2989		45	2180	
v/s Ratio Prot	0.00	0.07		0.02	0.01		0.12	0.42		0.00	0.16	
v/s Ratio Perm	0.00			0.02								
Critical LG?		Yes		Yes			Yes	Yes				
Act Effct Green (s)	21.3	12.1		22.5	10.3		14.5	46.9		6.9	30.2	
Actuated g/C Ratio	0.28	0.17		0.26	0.13		0.21	0.67		0.09	0.43	
v/c Ratio	0.01	0.40		0.14	0.07		0.59	0.63		0.03	0.38	
Uniform Delay, d1	20.7	29.4		22.2	34.8		29.8	11.4		37.2	15.3	
Percentile Delay	18.7	27.7		23.2	31.1		25.4	11.3		37.5	18.2	
Percentile LOS	B	C		C	C		C	B		D	B	

Area Type: Other
Cycle Length: 130
Actuated Cycle Length: 70.4
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Total Lost Time: 9
Sum of Critical v/s Ratios: 0.53
Intersection v/c Ratio: 0.57
Intersection Percentile Signal Delay: 14.9
Intersection Percentile LOS: B

Splits and Phases: 13: Abercorn & Rio Road



Lanes, Volumes, Timings

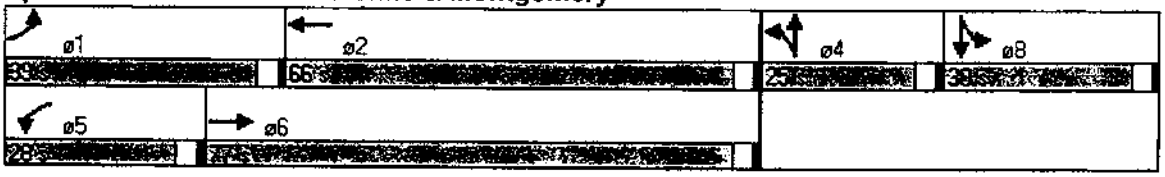
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	160		0	150		0	160		0	130		0
Storage Lanes	1		0	1		0	2		0	2		0
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.91	0.91	1.00	0.91	0.91	0.97	0.95	0.95	0.97	0.95	0.95
Frt Protected		0.987			0.961			0.939			0.968	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	5019	0	1736	4793	0	3467	3356	0	3335	3328	0
Frt Perm.		0.987			0.961			0.939			0.968	
Flt Perm.	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	5019	0	1736	4793	0	3467	3356	0	3335	3328	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Volume (vph)	63	1385	126	128	1211	423	165	137	94	312	167	46
Confl. Peds. (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.78	0.78	0.78	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	1%	1%	1%	5%	5%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	66	1458	133	135	1275	445	212	176	121	355	190	52
Lane Group Flow (vph)	66	1591	0	135	1720	0	212	297	0	355	242	0
Turn Type	Prot			Prot			Split			Split		
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases												
Detector Phases	1	6		5	2		4	4		8	8	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	39.0	77.0	0.0	28.0	66.0	0.0	25.0	25.0	0.0	30.0	30.0	0.0
Total Split (%)	24%	48%	0%	18%	41%	0%	16%	16%	0%	19%	19%	0%
Maximum Green (s)	35.0	73.0		24.0	62.0		21.0	21.0		26.0	26.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None		None	Min		Min	Min		None	None	

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Lane Grp Cap (vph)	149	2184		206	2252		529	512		582	581	
v/s Ratio Prot	0.04	0.32		0.08	0.36		0.06	0.09		0.11	0.07	
v/s Ratio Perm												
Critical LG?				Yes	Yes			Yes		Yes		
Act Effct Green (s)	10.8	44.1		14.5	47.6		15.6	15.6		17.7	17.7	
Actuated g/C Ratio	0.10	0.43		0.14	0.47		0.15	0.15		0.17	0.17	
v/c Ratio	0.36	0.73		0.56	0.77		0.40	0.58		0.61	0.42	
Uniform Delay, d1	43.9	23.6		42.4	22.1		38.6	39.7		38.5	37.1	
Percentile Delay	53.1	26.1		48.6	23.8		46.0	46.4		44.1	43.4	
Percentile LOS	D	C		D	C		D	D		D	D	

Area Type: Other
Cycle Length: 160
Actuated Cycle Length: 102
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Total Lost Time: 9
Sum of Critical v/s Ratios: 0.62
Intersection v/c Ratio: 0.66
Intersection Percentile Signal Delay: 30.8
Intersection Percentile LOS: C

Splits and Phases: 2: Derenne & Montgomery



Lanes, Volumes, Timings

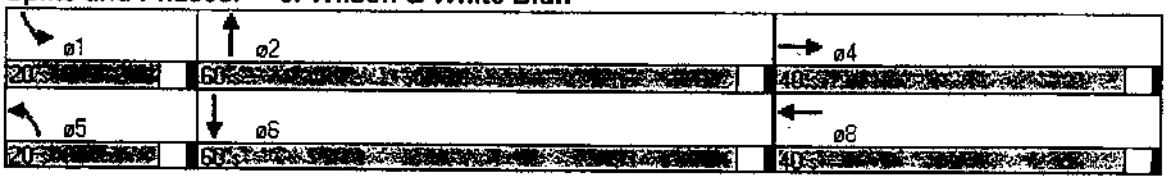
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	200		0	175		0
Storage Lanes	0		1	0		0	2		0	1		0
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50	50	50	50		50	50		50	50	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95	0.97	0.95	0.95	1.00	0.95	0.95
Frt Protected			0.850		0.964			0.995			0.989	
Flt Protected		0.982			0.988		0.950			0.950		
Satd. Flow (prot)	0	1829	1583	0	3371	0	3433	3522	0	1770	3500	0
Frt Perm.			0.850		0.964			0.995			0.989	
Flt Perm.		0.633			0.693		0.950			0.950		
Satd. Flow (perm)	0	1179	1583	0	2364	0	3433	3522	0	1770	3500	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			258		37			4			9	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Volume (vph)	93	158	373	84	182	85	345	1150	40	139	1173	92
Confl. Peds. (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	103	176	414	93	202	94	383	1278	44	154	1303	102
Lane Group Flow (vph)	0	279	414	0	389	0	383	1322	0	154	1405	0
Turn Type	Perm		Perm	Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8								
Detector Phases	4	4	4	8	8		5	2		1	6	
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0		8.0	20.0		8.0	20.0	
Total Split (s)	40.0	40.0	40.0	40.0	40.0	0.0	20.0	60.0	0.0	20.0	60.0	0.0
Total Split (%)	33%	33%	33%	33%	33%	0%	17%	50%	0%	17%	50%	0%
Maximum Green (s)	36.0	36.0	36.0	36.0	36.0		16.0	56.0		16.0	56.0	
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes			Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None	None	None	None		None	Min		None	Min	

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Lane Grp Cap (vph)		333	633		695		525	1810		202	1666	
v/s Ratio Prot							0.11	0.37		0.09	0.40	
v/s Ratio Perm		0.24	0.19		0.16							
Critical LG?		Yes					Yes			Yes	Yes	
Act Effct Green (s)		28.5	28.5		28.5		15.5	51.5		13.7	46.0	
Actuated g/C Ratio		0.29	0.29		0.29		0.16	0.52		0.13	0.46	
v/c Ratio		0.83	0.65		0.56		0.72	0.73		0.65	0.87	
Uniform Delay, d1		33.7	11.0		27.4		40.4	18.9		43.0	22.9	
Percentile Delay		39.6	12.9		28.8		46.8	22.5		46.3	25.1	
Percentile LOS		D	B		C		D	C		D	C	

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 99.9
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Total Lost Time: 9
Sum of Critical v/s Ratios: 0.75
Intersection v/c Ratio: 0.81
Intersection Percentile Signal Delay: 27.1
Intersection Percentile LOS: C

Splits and Phases: 6: Wilson & White Bluff



Lanes, Volumes, Timings

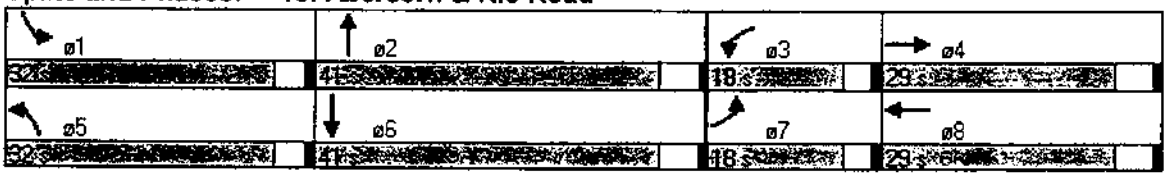
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	200		0	275		0	190		0
Storage Lanes	1		0	1		0	1		0	1		0
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frt Protected												
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1863	0	1770	1863	0	1770	5085	0	1770	5085	0
Frt Perm.												
Flt Perm.	0.742			0.376			0.950			0.950		
Satd. Flow (perm)	1382	1863	0	700	1863	0	1770	5085	0	1770	5085	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Volume (vph)	10	200	0	140	21	0	266	1337	0	27	1136	0
Confl. Peds. (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	11	222	0	156	23	0	296	1486	0	30	1262	0
Lane Group Flow (vph)	11	222	0	156	23	0	296	1486	0	30	1262	0
Turn Type	Pm+Pt			Pm+Pt			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phases	7	4		3	8		5	2		1	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.5	20.0		8.5	20.0		8.5	20.0		8.5	20.0	
Total Split (s)	18.0	29.0	0.0	18.0	29.0	0.0	32.0	41.0	0.0	32.0	41.0	0.0
Total Split (%)	15%	24%	0%	15%	24%	0%	27%	34%	0%	27%	34%	0%
Maximum Green (s)	14.0	24.0		14.0	24.0		28.0	36.0		28.0	36.0	
Yellow Time (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes			Yes			Yes			Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None		None	None		None	Min		None	Min	

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Lane Grp Cap (vph)	490	334		274	248		386	2769		92	1924	
v/s Ratio Prot	0.00	0.12		0.06	0.01		0.17	0.29		0.02	0.25	
v/s Ratio Perm	0.00			0.08								
Critical LG?		Yes		Yes			Yes				Yes	
Act Effct Green (s)	32.5	18.4		31.0	19.0		21.8	55.9		9.1	34.7	
Actuated g/C Ratio	0.32	0.19		0.30	0.19		0.24	0.60		0.09	0.38	
v/c Ratio	0.02	0.61		0.46	0.06		0.71	0.48		0.18	0.66	
Uniform Delay, d1	23.5	37.7		25.9	37.5		36.2	14.4		45.1	25.3	
Percentile Delay	24.4	39.7		31.3	34.3		38.1	17.4		49.6	29.5	
Percentile LOS	C	D		C	C		D	B		D	C	

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 92.5
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Total Lost Time: 12
Sum of Critical v/s Ratios: 0.59
Intersection v/c Ratio: 0.66
Intersection Percentile Signal Delay: 26.0
Intersection Percentile LOS: C

Splits and Phases: 13: Abercorn & Rio Road



Lanes, Volumes, Timings

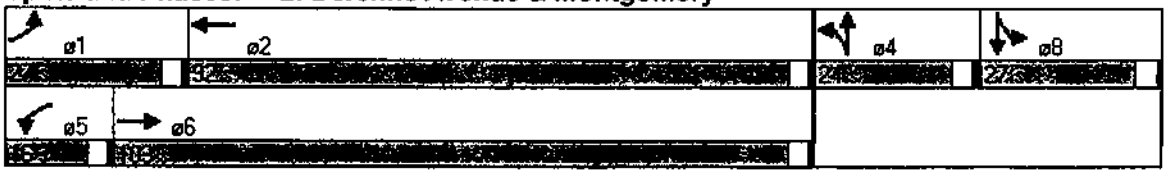
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	160		0	150		0	160		0	130		0
Storage Lanes	1		0	1		0	2		0	2		0
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.91	0.91	1.00	0.91	0.91	0.97	0.95	0.95	0.97	0.95	0.95
Frt Protected		0.987			0.976			0.963			0.952	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	5019	0	1787	5012	0	3433	3408	0	3467	3403	0
Frt Perm.		0.987			0.976			0.963			0.952	
Flt Perm.	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	5019	0	1787	5012	0	3433	3408	0	3467	3403	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Volume (vph)	128	1763	162	60	1757	330	385	206	66	330	218	104
Confl. Peds. (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.96	0.96	0.96	0.84	0.84	0.84	0.76	0.76	0.76
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	139	1916	176	62	1830	344	458	245	79	434	287	137
Lane Group Flow (vph)	139	2092	0	62	2174	0	458	324	0	434	424	0
Turn Type	Prot			Prot			Split			Split		
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases												
Detector Phases	1	6		5	2		4	4		8	8	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	27.0	103.0	0.0	16.0	92.0	0.0	24.0	24.0	0.0	27.0	27.0	0.0
Total Split (%)	16%	61%	0%	9%	54%	0%	14%	14%	0%	16%	16%	0%
Maximum Green (s)	23.0	99.0		12.0	88.0		20.0	20.0		23.0	23.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None		None	Min		Min	Min		None	None	

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Lane Grp Cap (vph)	206	2834		109	2551		494	491		520	511	
v/s Ratio Prot	0.08	0.42		0.03	0.43		0.13	0.10		0.13	0.12	
v/s Ratio Perm												
Critical LG?	Yes				Yes		Yes			Yes		
Act Effct Green (s)	17.4	84.3		10.6	74.9		21.6	21.6		22.4	22.4	
Actuated g/C Ratio	0.12	0.57		0.07	0.50		0.15	0.15		0.15	0.15	
v/c Ratio	0.67	0.73		0.49	0.86		0.92	0.66		0.83	0.83	
Uniform Delay, d1	63.2	24.2		68.2	31.8		63.1	60.4		61.6	61.6	
Percentile Delay	65.9	24.4		72.2	32.4		97.8	65.0		69.9	69.7	
Percentile LOS	E	C		E	C		F	E		E	E	

Area Type: Other
Cycle Length: 170
Actuated Cycle Length: 148.6
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Total Lost Time: 12
Sum of Critical v/s Ratios: 0.77
Intersection v/c Ratio: 0.83
Intersection Percentile Signal Delay: 42.7
Intersection Percentile LOS: D

Splits and Phases: 2: Derenne Avenue & Montgomery



Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰↑↱		↰↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	200		0	175		0
Storage Lanes	0		1	0		0	2		0	1		0
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50	50	50	50		50	50		50	50	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95	0.97	0.95	0.95	1.00	0.95	0.95
Frt Protected			0.850		0.925			0.999			0.996	
Flt Protected		0.988			0.992		0.950			0.950		
Satd. Flow (prot)	0	1840	1583	0	3248	0	3433	3536	0	1770	3525	0
Frt Perm.			0.850		0.925			0.999			0.996	
Flt Perm.		0.866			0.836		0.950			0.950		
Satd. Flow (perm)	0	1613	1583	0	2737	0	3433	3536	0	1770	3525	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			338		126			1			3	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Volume (vph)	57	183	549	37	76	113	236	1514	12	158	1988	49
Confl. Peds. (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	63	203	610	41	84	126	262	1682	13	176	2209	54
Lane Group Flow (vph)	0	266	610	0	251	0	262	1695	0	176	2263	0
Turn Type	Perm		Perm	Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8								
Detector Phases	4	4	4	8	8		5	2		1	6	
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0		8.0	20.0		8.0	20.0	
Total Split (s)	35.0	35.0	35.0	35.0	35.0	0.0	25.0	50.0	0.0	25.0	50.0	0.0
Total Split (%)	32%	32%	32%	32%	32%	0%	23%	45%	0%	23%	45%	0%
Maximum Green (s)	31.0	31.0	31.0	31.0	31.0		21.0	46.0		21.0	46.0	
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes			Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None	None	None	None		None	Min		None	Min	

6: Wilson & White Bluff

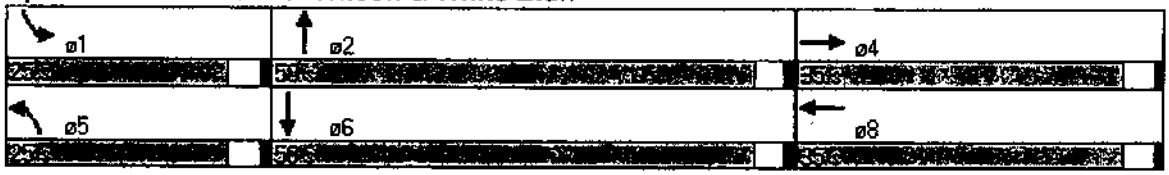
Baseline 8/11/2000

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Lane Grp Cap (vph)		427	668		818		474	1713		282	1784	
v/s Ratio Prot							0.08	0.48		0.10	0.64	
v/s Ratio Perm		0.16	0.24		0.08							
Critical LG?			Yes							Yes	Yes	
Act Effct Green (s)		26.2	26.2		26.2		13.7	47.7		15.7	49.8	
Actuated g/C Ratio		0.27	0.27		0.27		0.14	0.48		0.16	0.50	
v/c Ratio		0.62	0.91		0.31		0.55	0.99		0.62	1.27	
Uniform Delay, d1		31.8	15.2		13.9		39.6	25.1		38.6	24.3	
Percentile Delay		32.4	20.9		14.2		41.0	60.8		40.0	139.5	
Percentile LOS		C	C		B		D	E		D	F	

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 98.8
Natural Cycle: 100
Control Type: Actuated-Uncoordinated
Total Lost Time: 9
Sum of Critical v/s Ratios: 0.98
Intersection v/c Ratio: 1.07
Intersection Percentile Signal Delay: 83.6
Intersection Percentile LOS: F

Splits and Phases: 6: Wilson & White Bluff



Lanes, Volumes, Timings

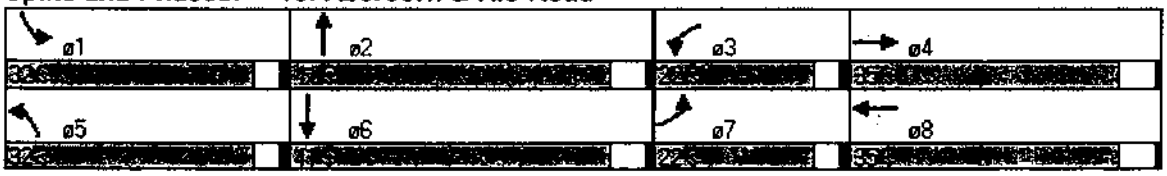
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	200		0	275		0	190		0
Storage Lanes	1		0	1		0	1		0	1		0
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frt Protected												
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1863	0	1770	1863	0	1770	5085	0	1770	5085	0
Frt Perm.												
Flt Perm.	0.753			0.137			0.950			0.950		
Satd. Flow (perm)	1403	1863	0	255	1863	0	1770	5085	0	1770	5085	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Volume (vph)	2	347	0	206	6	0	249	1632	0	40	1571	0
Confl. Peds. (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	2	386	0	229	7	0	277	1813	0	44	1746	0
Lane Group Flow (vph)	2	386	0	229	7	0	277	1813	0	44	1746	0
Turn Type	Pm+Pt			Pm+Pt			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phases	7	4		3	8		5	2		1	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		8.0	20.0		8.0	20.0	
Total Split (s)	22.0	35.0	0.0	22.0	35.0	0.0	32.0	41.0	0.0	32.0	41.0	0.0
Total Split (%)	17%	27%	0%	17%	27%	0%	25%	32%	0%	25%	32%	0%
Maximum Green (s)	18.0	30.0		18.0	30.0		28.0	36.0		28.0	36.0	
Yellow Time (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes			Yes			Yes			Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None		None	None		None	Min		None	Min	

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Lane Grp Cap (vph)	718	489		268	146		332	2222		114	1598	
v/s Ratio Prot	0.00	0.21		0.12	0.00		0.16	0.36		0.02	0.34	
v/s Ratio Perm	0.00			0.07								
Critical LG?		Yes		Yes			Yes				Yes	
Act Effct Green (s)	46.6	28.8		30.9	15.0		23.5	54.9		9.5	38.4	
Actuated g/C Ratio	0.39	0.24		0.24	0.12		0.20	0.46		0.08	0.32	
v/c Ratio	0.00	0.87		0.85	0.03		0.80	0.78		0.32	1.08	
Uniform Delay, d1	20.5	43.0		45.2	53.4		49.1	30.9		56.2	43.0	
Percentile Delay	23.0	51.0		53.3	44.2		47.2	30.0		55.4	94.1	
Percentile LOS	C	D		D	D		D	C		E	F	

Area Type: Other
Cycle Length: 130
Actuated Cycle Length: 120.5
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Total Lost Time: 12
Sum of Critical v/s Ratios: 0.83
Intersection v/c Ratio: 0.91
Intersection Percentile Signal Delay: 59.2
Intersection Percentile LOS: E

Splits and Phases: 13: Abercorn & Rio Road



Appendix C Alternatives Engineering and Construction Cost

HUNTER ARMY AIRFIELD
GEORGIA
Alternate to Connect North Parimeter Road to Duncan Drive

ITEM NO.	DESCRIPTION	QUANTITY		COST/UNIT	TOTAL COST
0203-0001	EXCAVATION	12000	CY	$15.00	$180,000.00
0309-0410	SUPERPAVE ASPHALT MIXTURE DESIGN, 64-22, 0.3 TO < 3.0 MILLION DESIGN MIXTURE, 9 in. DEPTH	15500	SY	$18.00	$279,000.00
0409-4542	SUPERPAVE ASPHALT MIXTURE DESIGN, RPS, PG 64-22, 3.0 TO 10.0 MILLION MM MIXTURE, 1.5 in. DEPTH, SRL-H	15500	SY	$3.00	$46,500.00
0409-8560	SUPERPAVE ASPHALT MIXTURE DESIGN, RPS, PG 64-22, 3.0 TO 10.0 MILLION MM MIXTURE, 3 in. DEPTH, SRL-H	15500	SY	$5.00	$77,500.00
0350-0107	Subbase, 7" Depth (No. 2A)	15500	SY	$4.75	$73,625.00
	PLAIN CONCRETE MOUNTABLE CURB	3590	LF	$10.00	$35,900.00
	CUL-DE-SAC	1	LS	$6,884.58	$6,884.58
	BUILDING	1	LS	$5,000.00	$5,000.00
	PAVEMENT MARKINGS	4000	LS	$0.50	$2,000.00
	SIGNALS	1	LS	$70,000.00	$70,000.00
					$706,409.58

	DRAINAGE & E&S (4%)	$28,256.38
	SIGNS (1%)	$7,064.10
	MPT (2%)	$14,128.19
	ENGINEERING (10%)	$70,640.96
	UTILITIES (10%)	$70,640.96
		$190,730.59

ROADWAY	$706,409.58
OTHER	$190,730.59
CONTINGENCY (20%)	$179,428.03
TOTAL	**$1,076,568.20**

HUNTER ARMY AIRFIELD, GEORGIA
JOB 37737.001

COST BACK-UP

Pavement (and base drain)

Pavement:

ITEM #	ITEM	COST	UNIT
0309-0410	SUPERPAVE ASPHALT MIXTURE DESIGN, 64-22, 0.3 TO < 3.0 MILLION DESIGN MIXTURE, 9 in. DEPTH	$18.00	SY
0409-4542	SUPERPAVE ASPHALT MIXTURE DESIGN, RPS, PG 64-22, 3.0 TO 10.0 MILLION MM MIXTURE, 1.5 in. DEPTH, SRL-H	$3.00	SY
0409-8560	SUPERPAVE ASPHALT MIXTURE DESIGN, RPS, PG 64-22, 3.0 TO 10.0 MILLION MM MIXTURE, 3 in. DEPTH, SRL-H	$5.00	SY
0350-0107	Subbase, 7" Depth (No. 2A)	$4.75	SY
		$30.75	SY

$30.75	per SY	x	4.7	SY / LF =	$143.50	LF of road	(subtotal)

Base Drain:

0610-7002 6 " Pavement Base Drain

$5.50	per LF	x	2	pipes =	$11.00	LF of road	(subtotal)
					$154.50	LF of road	(total)

Earthwork

0230-0001 Class 1 Excavation — $8.00 CY

$8.00	per CY	x	3.4	CY / LF =	$27.13	LF of road

Right-of-Way

Assumed land value (no developed)	$5,000.00	AC	
Assumed land value (developed)	$50,000.00	AC	(developed)

	43560	ft per acre /	42	ft. width =	1037.14	LF / acre	
therefore	$5,000.00	/	1037.14	LF / acre =	$4.82	LF of road	
therefore	$50,000.00	/	1037.14	LF / acre =	$48.21	LF of road (developed)	

Clearing and Grubbing

0201-0001

	43560	ft per acre /	42	ft. width =	1037.14286	LF / acre	
therefore	$5,000.00	/	1037.1	LF / acre =	$4.82	LF of road	

Total Cost for a New Roadway - Not at Bridge (excluding contingency)

$191.27	LF of road
$234.66	LF of road (developed)

HUNTER ARMY AIRFIELD
GEORGIA

NOTE: Costs all reflect costs that would be used in District 8 in Pennsylvania

Roadway Assumptions:

Lane Width =	12 ft
Shoulder Width =	10 ft
Median Width=	8 ft

Pavement Cross Seciton (Width = 12+12+10+8 = 42 ft)

SUPERPAVE ASPHALT MIXTURE DESIGN, 64-22, 0.3 TO < 3.0 MILLION DESIGN MIXTURE, 9 in. DEPTH

SUPERPAVE ASPHALT MIXTURE DESIGN, RPS, PG 64-22, 3.0 TO 10.0 MILLION MM MIXTURE, 1.5 in. DEPTH, SRL-H

SUPERPAVE ASPHALT MIXTURE DESIGN, RPS, PG 64-22, 3.0 TO 10.0 MILLION MM MIXTURE, 3 in. DEPTH, SRL-H

Subbase, 7" Depth (No. 2A)

= 42' / 9 = 4.7 SY per lineal ft of road

Average Cross sectional area of earthwork

Roadway 42' x 20.5" depth =	8.0	SY
Tie-in = 10' x 1' x 2 sides=	2.2	SY
TOTAL =	10.2	SY
or		
	3.4	CY per lineal ft

Removal of Pavement

Roadway 100' x 18" depth =	16.7	SY
or		
	1.9	CY

HUNTER ARMY AIRFIELD, GEORGIA
JOB 37737.001

Cul-de-Sacs

Pavement	195 SY	x	$30.75 /SY =	$5,996.25	per cul-de-sac
Earthwork	195 SY	x	20.5 " depth	111.04	CY
	111.04 CY	x	$8.00 /CY	$888.33	per cul-de-sac

Total Cost for a New Cul-de-Sac (excluding contingency)

$6,884.58	**per cul-de-sac**

Other Roadway Costs

Earthwork - Foreign Borrow	$15.00	CY			
Guide Rail	$13.00	LF			
Removal of Pavement (Class 1 Excavation)	$8.00	CY	x	1.97	CY per LF
			=	$15.76	per LF

HUNTER ARMY AIRFIELD

GEORGIA

Alternate to Connect North Parimeter Road to Duncan Drive

ITEM NO.	DESCRIPTION	QUANTITY		COST/UNIT	TOTAL COST
0203-0001	EXCAVATION	12000	CY	$15.00	$180,000.00
0309-0410	SUPERPAVE ASPHALT MIXTURE DESIGN, 64-22, 0.3 TO < 3.0 MILLION DESIGN MIXTURE, 9 in. DEPTH	15500	SY	$18.00	$279,000.00
0409-4542	SUPERPAVE ASPHALT MIXTURE DESIGN, RPS, PG 64-22, 3.0 TO 10.0 MILLION MM MIXTURE, 1.5 in. DEPTH, SRL-H	15500	SY	$3.00	$46,500.00
0409-8560	SUPERPAVE ASPHALT MIXTURE DESIGN, RPS, PG 64-22, 3.0 TO 10.0 MILLION MM MIXTURE, 3 in. DEPTH, SRL-H	15500	SY	$5.00	$77,500.00
0350-0107	Subbase, 7" Depth (No. 2A)	15500	SY	$4.75	$73,625.00
	SIDEWALK	6950	SY	$40.00	$278,000.00
	CUL-DE-SAC	1	LS	$6,884.58	$6,884.58
	BUILDING	1	LS	$4,000.00	$4,000.00
	PAVEMENT MARKINGS	4000	LS	$0.50	$2,000.00
	SIGNALS	1	LS	$70,000.00	$70,000.00
					$947,509.58

	DRAINAGE & E&S (4%)	$37,900.38
	SIGNS (1%)	$9,475.10
	MPT (2%)	$18,950.19
	ENGINEERING (10%)	$94,750.96
	UTILITIES (10%)	$94,750.96
		$255,827.59

ROADWAY	$947,509.58
OTHER	$255,827.59
CONTINGENCY (20%)	$240,667.43
TOTAL	**$1,444,004.60**

HUNTER ARMY AIRFIELD

GEORGIA

Alternate to Place Interchange at Stephen Douglas Street

ROADWAY

ITEM	QUANTITY	UNIT	UNIT COST	COST
New Pavement	6717	LF	$154.50	$1,037,776.50
Guide Rail	27000	LF	$13.00	$351,000.00
Earthwork (borrow)	31094	CY	$15.00	$466,410.00
Right-of-Way	10	AC	$5,000.00	$50,000.00
Clearing and Grubbing	10	AC	$5,000.00	$50,000.00
Retaining Walls	1	LS	$1,500,000.00	$1,500,000.00

$3,455,186.50 subtotal

STRUCTURES

Structures	1	LS	$10,750,000.00	$10,750,000.00

$10,750,000.00 subtotal

Drainage & E&S (4%)	$568,207.46
MPT (2%)	$284,103.73
Signing (1%)	$142,051.87
Engineering (10%)	$1,420,518.65
Utilities (10%)	$1,420,518.65

$3,835,400.36 subtotal

ROADWAY	$3,455,186.50
STRUCTURES	$10,750,000.00
OTHER	$3,835,400.36
CONTINGENCY (20%)	$3,608,117.37
TOTAL	**$21,648,704.23**

HUNTER ARMY AIRFIELD
GEORGIA
Alternate to Place Interchange off Southwest Bypass

ROADWAY

ITEM	QUANTITY	UNIT	UNIT COST	COST
New Pavement	3017	LF	$154.50	$466,126.50
Guide Rail	12068	LF	$13.00	$156,884.00
Earthwork (borrow)	136062	CY	$15.00	$2,040,930.00
Right-of-Way	15	AC	$50,000.00	$750,000.00
Clearing and Grubbing	15	AC	$50,000.00	$750,000.00
Retaining Walls	1	LS	$1,500,000.00	$1,500,000.00

$5,663,940.50 subtotal

STRUCTURES

Structures	1	LS	$13,750,000.00	$13,750,000.00

$13,750,000.00 subtotal

Drainage & E&S (4%)	$776,557.62
MPT (2%)	$388,278.81
Signing (1%)	$194,139.41
Engineering (10%)	$1,941,394.05
Utilities (10%)	$1,941,394.05

$5,241,763.94 subtotal

ROADWAY	$5,663,940.50
STRUCTURES	$13,750,000.00
OTHER	$5,241,763.94
CONTINGENCY (20%)	$4,931,140.89
TOTAL	**$29,586,845.32**

Appendix D
Benefit-Cost Analysis

Gannett Fleming

SUBJECT

SHEET NO. OF

JOB NO.

BY DATE CHKD. BY DATE

Location 1	B	309,680	=	0.19
	C	1,589,366		
2	B	309,680		
	C	2,178,020	=	0.14
3	B	309,680		
	C	103,014	=	3.01

Gannett Fleming

SUBJECT | SHEET NO. | OF
JOB NO.
BY | DATE | CHKD. BY | DATE

Benefit - Crash Reduction

At Decrease & Mont 1/97 - 12/99

A. 197 crashes or 66/yr 21.3% involved injury
55.4% were rear-end
[illegible] angle

WB → 3.7 crash/yr & 8 injuries

Signal improvement is 31% of all
signal timing improvem is 10%

timing changes will reduce these by 20% or
result in 7.4 crashes prevented
& 2 injury

B. traffic (NB) at mont will decrease by 46%. therefore it was assumed crashes on NB will decrease 46%

14/3yrs = 5/yr x .46 = 2 crashes prevented
0 injuries

Total Estimated Reduction 9.4 crashes
2 injuries

C. Crash cost [illegible]

crash	2,200	X 9.4		20,680
inj	59,00	X 2.0	=	118,000
fatal	2.8 million	X 0	=	0
				$138,680/yr

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Benefit - Force Deployment

Deployed 45000 over 2 yrs
+ Ranger 4000 vehs/yr

≈ 30,000 people/yr

assume $1.5 per person for value of $45,000/yr

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Benefit – Delay & Savings

65 hours delay

PM 42.7 sec/veh LOS D int volume 5590 Δ 673 veh

int volume 4593

proposed new grade LOS B int LOS C

PM 12.8 sec/veh 29.1

37 hours delay

17 hour

63 sec veh +

54

10 hours delay
Swd pm peak
15% saved

97 ADT max total entering intersection
55350

20,400,000 veh/yr x 6.5 sec/veh = 1 hr / 3600 sec . 1 day / 24 hr . 1 yr / 365 day = 4.2 yr

4.2 x 27,500 yr = $126,000

≈ avg annual income

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Gate Automation B/C

Estimated costs for automated devices:

- Sliding gate - $20,000 each
- Gate for up to a 20' arm - $3,000 each
- Loop detector to close gate after vehicle goes through or to open gate when vehicle exits - $250 each
- Photo eye (prevents closure if beam is broken) - $200 each
- Card reader with gooseneck pad - $1,250 each
- Cards - $3.25 each
- Camera - $6,000 each (IR illuminators -
- Fiber optic matrix switch - $5,000 total
- Fiber optic modems - $5,000 total
- Fiber optic cable - $1 per linear foot (does not include trenching and conduit)
- Camera control cabinet - $5,000 total
- Video server – $2,000 total
- Video workstation (2 Monitors 21") - $6,000 total
- Video recorder - $2,250 total

	Estimated Daily Traffic (in/out/total)	Number of Lanes (per direction)	Type of Control Suggested	Cost of Automated Control
Rio Gate	Inbound 531 Outbound 331 Total 862	One	Automated	$49,000
Proposed Tibet Gate	Inbound1,793 Outbound 1,722 Total 3,515	One	Automated	$49,000
Wilson Gate	Inbound 4,029 Outbound 3,921 Total 7,950	Two	Manned/ Automated	$11,000
Proposed Location 1 or 3	Inbound 3,901 Outbound 4,081 Total 7,982	Two	Manned/ Automated	$11,000
Miscellaneous costs of gate automation including fiber optic cable and a surveillance station are expected to cost >$60,000. This cost does not include design and labor as well as system integration or training.				

Cost of Automation

Total cost of 180,000 or 16,189/yr

AAC - Service life hyd ~~cylinders~~ 15 years - operator

~~cylinders~~

Worse case at 4% inflation = 16,189

- Maintenance (300/gate) = 1200/yr
- Operation 24/7 surveillance = 75,000/yr
- Manpower for unautomated cost (2 at Derenne + 2 Wilson = 4 x 75,000/yr

$467,400/yr

Roosolut - 200,000 Roads AS

See worksheet

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Cost to monitor gates without automation

Cost at Rio ₹30,000 - from 8/7 email

Rio Gate	75 x 2
Tibet	75 x 2
Wilson	75 x 2
Deremne	75 x 2
	630,000 yr

$$B/C = \frac{630}{467} = 1.35$$

Improvement	Expected Result	Initial Improvement Cost	Annualized Improvement Cost	Improvement Life (Years)	Reduction Factor	Annual Accident Damage Addressed PROPERTY	INJURY	FATAL	Annual Monetary Benefit	B/C Ratio
Location										
Gate Automation		$180,000	$16,189	15				0	$0	0.00
Location 1		$21,600,000	$1,589,366	20				0	$0	0.00
Location 2		$29,600,000	$2,178,020	20				0	$0	0.00
Location 3		$1,400,000	$103,014	20				0	$0	0.00

NOTES:
(1) ANNUAL RATE OF INFLATION ASSUMED TO BE 4 PERCENT.
(2) THIS IMPROVEMENT SHOULD BE CONSIDERED IF OTHER IMPROVEMENTS FAIL TO REDUCE THE CURRENT ACCIDENT RATE.
(3) THIS IMPROVEMENT IS A LONG-TERM IMPROVEMENT INDEPENDENT OF OTHER SHORT-TERM IMPROVEMENTS IDENTIFIED.